Vol. XII. February, 1897. No. 2.

354520

PAVING SEWERAGE MUNICIPAL ENGINEERING WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS. STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS NEW YORK

Two Dollars Per Year. Single Copies, 25 Cents.

ASPHALT PAVEMENTS

THE BARBER ASPHALT PAVING COMPANY

NO. 1 BROADWAY, NEW YORK

•• ESTABLISHED ••
1878

•• INCORPORATED ••
1883

HIGHEST AWARDS
WORLD'S
EXPOSITION

RECEIVED AT
COLUMBIAN
CHICAGO, 1893

1st. *Asphalt and Asphaltic Cements:* The Refined Asphalt and Asphaltic Cements for Pavements and Asphaltic Mastics are of excellent quality and up to the required standard. They are therefore worthy of an award.

2d. *Trinidad Asphalt Pavements:* The Trinidad Asphalt Pavements for streets, laid according to the several methods by "The Barber Asphalt Paving Company" upon concrete foundations, old stone block and other pavements, are adapted to all climates. They are remarkable for quantity, quality, ease of traction, noiselessness, ease of cleaning, sanitary value, economy of maintenance and handsome appearance, and are worthy of an award.

3d. *Machinery and Processes:* The models, samples, etc., show clearly and fully the Machinery, Processes and Materials for the manufacture of Asphalt Pavements and Mastics. They are worthy of an award.

Municipal Engineering

VOLUME XII. FEBRUARY, EIGHTEEN NINETY-SEVEN. NUMBER 2.

METHODS OF PAYING FOR STREET IMPROVEMENTS.

By Charles Carroll Brown, M. Am. Soc. C. E.

The methods of raising the money to pay for street improvements are almost as numerous as the cities, but they are founded upon a few basic principles which are combined in cases difficult of classification because partaking of the character of more than one class.

1. The entire assessment of cost may be levied upon property abutting on the street.

2. It may be levied on a district in proportion to benefits.

3. The city may be included in the list of property-owners for a part or all the cost of paving intersections with other streets or alleys.

4. The city may pay a definite proportion of the cost and the property benefited the remainder.

5. The property may pay for part of the cost; for example, curbing, guttering or grading, and the paving proper be assessed according to one of the preceding ways.

6. The city may pay the entire amount of paving.

7. The work may be divided as indicated in (5) and the city pay all of one or more divisions of the work and the property the remainder.

The terms of payment are almost as various as the methods of assessment.

8a. The entire sum may become an immediate lien upon the property, collectible by the contractor directly within a definite time after the assessment ordinance is passed, the property-owner being obliged to make his terms with the contractor directly.

8b. The same may occur with the city as the collector, the city being responsible to the contractor for the payment of the money.

8c. The same may occur, the city acting only as collecting agent for the contractor, who must wait until the property-owner pays his assessment before obtaining his money.

9a. The amount of the levy may be divided into 3, 5 or 10, or other number of equal installments, payable annually or semi-annually, with or without interest on deferred payments. The warrants or bonds representing these deferred payments may be issued against the individual properties and the contractor made the collector.

9b. The city may pay the contractor and collect the money from the property-owners as other taxes are collected, the contractor receiving cash or city bonds, the bonds being liens simply on the paving district, or being general city bonds.

9c. The city may issue its bonds in such case on the paving district fund, which will be paid only as the assessments in the district are paid in, but may be renewed as

they become due if funds are not available for their retirement.

10. The city may raise a paving fund by general tax or by selling bonds, and pay for improvements as made, the assessment and collection of taxes or assessments being quite independent of the payment for work done and possibly under an independent department.

Doubtless there are many cases which can not be assigned definitely to one of these classes, but they cover the ordinary practice either in themselves or in various combinations. One object of this article is to call out descriptions of other methods, especially if they are better in practice.

Local conditions at a particular time generally determine the method of assessment and collection, and sometimes it is exceedingly difficult to get rid of an unwieldy and cumbersome method which seemed to fit the particular conditions of the one time, but which is soon outgrown. Careful study of the local conditions and consideration of the possible lines of growth is necessary in fixing a system of assessment. Systems of collection are perhaps more readily modified to suit the demands of the times.

(1) Perhaps Indianapolis is as perfect an example as any of the first class. The city here pays nothing, the entire cost being uniformly distributed over the frontage of the street, excepting that one-half the cost of intersections is assessed against the property abutting on the cross street or alley to the next street intersecting the cross street, in each direction, and one-half the cost of the center of the newly improved street at an entering street is assessed on the property abutting the street as far as the first intersecting street. To make the assessment equitable, the width of pavement in one contract must be uniform throughout, excepting that the intersections may be carried out to the lines of the front of the property. Whenever there is a change in the width of pavement, there must be a new resolution and contract. This method was adopted because the city wished to improve its street, was bonded up to the limit of its indebtedness, did not wish to raise its general tax rate, and considered that the pavements were of sufficient value to the abutting property to warrant assessing it with the entire cost. If the scheme of improvements is general and is proceeded with at a reasonably rapid rate there can be no exception to this last argument, but where only a few of the principal streets are paved for the use of the entire population when doing business in town, it is more equitable for the people at large to pay a portion of the cost.

(2) Omaha may be cited as in the second class. The district benefited seldom extends more than a lot or two in width beyond the abutting property, because the benefit is usually considered to be restricted to a certain distance back from the street lines. The distance is divided into six equal parts, the part abutting on the street receiving one-third the frontage assessment, the next one-fifth, the next one-sixth and the last three, each one-tenth, the frontage assessment being made in the manner of the first class or the fourth class, according to the petition or order of council regarding the improvement. Grading, curbing and paving are generally done under different ordinances and contracts, as the charter provisions are slightly different as regards some of the steps.

(3) Most cities are in this class.

whatever other class they may belong to.

(4) Many cities determine the portion of the cost to be borne by the city at large, arbitrarily, and some are required by charter or statute to pay one-third, one-half or two-thirds or some other proportion, the property be ng assessed the remainder.

(5 and 7) Practice varies in almost every conceivable way in these classes.

(6) Very few streets are paved the first time at the expense of the city entirely, but many cities are required to meet the expense of repaving or of a large share of it out of general city funds; *e. g.*, Cleveland pays one-half such expense. Milwaukee pays all over a total cost for paving of $3 a square yard for the pavement to the middle of the street in front of the property.

(8) Few cities now require the entire payment for the pavement to be made at once. The three methods of collection noted in the divisions a, b and c, of classes 8 and 9, are in vogue in various cities. The method making the contractor the collector is objectionable as either he must bid a high price for his work or the interest penalty for deferring settlement must be large, either making heavier expense to the tax-payer. That requiring the contractor to wait for his money until it is collected also causes him to add an interest charge to his bid, probably more than sufficient to meet the expected delays, thus increasing the cost again. If the city pays the contractor and looks to the property-owners for reimbursement, it must pay interest on the deferred payments. The city can usually float bonds at a low rate of interest, and if the interest on deferred assessments is made materially higher than the usual interest, so that there will be no inducement to let it run, it may more than pay the expenses of the proceedings, and will act as a spur to prompt payment.

(9) The "Barrett law" in Indiana and the modification of it in use in Indianapolis are practical examples of this class. Under this law the property-owner may pay all the assessment at once, but if he prefers the assessment is divided into ten parts, payable annually, deferred payments bearing six per cent. interest, the interest being payable semi-annually. The coupons thus represent alternately one-tenth the principal with six months interest on all unpaid installments, and six months interest. In Indianapolis the bonds are issued as liens on the property, so that there are many bonds for odd amounts. The semi-annual coupons can not be cashed unless the corresponding payment has been made. Failure to pay any installment makes all due, and the holder of the bond can proceed to foreclose his lien on the property against which it was issued. This method of procedure makes the bonds undesirable for outside investors, and, although they bear six per cent. interest, they are usually quoted at some discount, generally small. A slight change in the procedure would enable the city to issue bonds on the district as a whole, and for even amounts and for even years, instead of having odd amounts and an investment diminishing each year. These bonds could be floated at a premium for four or five per cent., and by still charging six per cent. on the deferred payments the slight difference in interest would pay the expenses of the collection. A penalty of a still higher per cent. on the over-due installments

might also be a good provision. These latter provisions are very nearly those in Omaha.

(10) Perhaps the simplest method is that in this class. The principal difficulty seems to be that between the two departments of assessment and appropriation there is liable to be some failure to compare notes, and indebtedness increases too rapidly to be met by collections. There is also more temptation to extravagance when the tax-payer's complaints are too far removed from the bureau responsible for the magnitude of the bills for improvements.

The question of who should pay for repairs and for repavement is one of as much importance as the question of payment for the first improvement. When permanent pavements are general throughout the city the repaving is more frequently necessary on the streets with the most travel, which are, with perhaps one exception, the streets in the business parts of town where the assessed valuation of property is higher in proportion to the frontage, and where the pavements are of more proportional value to the property than in residence portions. This highly valued property would therefore pay the larger proportion of the cost of pavements if the money was raised by general tax. If the entire cost of repaving is paid by the abutting property, portions of the taxable real estate in unimproved districts would pay nothing for the repavement of these main streets, which are more rapidly worn, because of the use of them by the owners and occupants of such property in common with the great majority of the inhabitants of the city. The tax-payer who owns no real estate also escapes his share of the burden of keeping up such well-traveled streets, which are doubtless deteriorating on account of wear for which he is in part responsible. One class of streets, not strictly residence or business streets, is that made up of thoroughfares from one portion of the city to another, or to districts outside. These streets are frequently spoiled as residence streets, and are not good business streets, but the pavements are subject to quite as much wear as many strictly business streets. Without doubt equity would demand that the repavement of such streets should be done largely at the cost of the city at large or of a large district.

When permanent pavements are not general in a city the owner of residence property does not pay his proper share of repaving for his use of the improved streets, if the cost of repaving is assessed entirely upon the abutting property.

These considerations indicate clearly that a portion of the cost of repaving should be borne by the city at large. The position to be so carried in proportion to the assessment upon the abutting property will depend upon local conditions such as those just outlined. Where permanent pavements are general the equitable proportion to be paid by the city will decrease when the population of the city increases, but in a less ratio.

It is the general custom to pay for repairs from the general city funds, and this is usually equitable. But little study of the economy of repairs and repaving is made and other conditions usually determine when a new pavement is to be constructed. There is for every street a condition which is at the boundary between economical repairs and renewal. The determination of the time of reaching this condition is not difficult if proper

detailed accounts of repairs are kept in some such manner as that in vogue in Buffalo (described in another column). A vehicle tax, assessing a reasonable fee, graduated for every class of vehicle and number of animals, from bicycle to heavy four-horse truck, is an equitable source of revenue for street repairs and the city's portion of renewals, for it reaches the persons responsible for the wear of the pavements directly, many of whom can not be reached in any other way.

OWNERSHIP AND CAPACITY OF WATER-WORKS IN AMERICAN CITIES.

Of the cities in the accompanying table with population between 50,000 and 100,000, but four have full gravity supplies, three of these being in New England and one in Utah. Cambridge, Mass., and Troy, N. Y., have part gravity supply. Eight pump to reservoir, five pump direct, three of these having stand-pipes, three are partly reservoir and partly direct systems. Charleston, S. C., has artesian wells and pumps. But four of the systems are of private ownership, and seventeen are owned by the cities. This is not the relative number in the country, however, as the companies owning plants are not so willing to reply to questions regarding the capacity and operation of their works as the officials in charge of city works. The gravity supplies, except Salt Lake City, have much larger reservoir capacity than the pumping and reservoir systems. Thus Lynn has 268 days' supply in its reservoirs, Hartford 266 days and Springfield 497 days' supply, while Salt Lake City has little more than a half-day's supply. The following arranges the cities pumping their water in the order of their pumping capacity in proportion to the consumption. Dallas has pumping capacity of 7.1 times the daily consumption and a reservoir with capacity for 120 days' supply.

	Pumping Capacity.	Reservoir.
Lowell	6.3 times	4.3 times consumption.
Manchester	4.6 "	5.4 " "
Covington	4.0 "	4.4 " "
Cambridge	3.8 "	0.8 " "
Des Moines	3.7 "	0 " "
Erie	3.6 "	6.2 " "
Lawrence	3.3 "	13.3 " "
Charleston	3.3 "	6.6 " "
Trenton	2.9 "	5.7 " "
Augusta	2.6 "	0 " "
Nashville	2.4 "	4.2 " "
Memphis	2.1 "	0 " "
Evansville	1.2 "	0 " "
Troy	1.1 "	5.2 " "

Cambridge and Troy are partly supplied by gravity.

The cities which have provided reservoir capacity have also generally supplied ample pumping capacity. The cities deficient in either are readily selected from the list.

Of supplies drawn from rivers, Lowell, Grand Rapids, Des Moines, Evansville, Troy, Manchester, Covington, do not make use of either settling basins or filters, but the reservoirs of Lowell, Troy, Manchester and Covington answer the purpose of settling basins to some extent. Only Nashville, Trenton and Lawrence use filters.

The consumption per capita ranges from 300 gallons per day at Salt Lake City, where water is furnished for irrigation, also, to 24 at Charleston, S. C., where a private company furnishes a portion of the population. Salt Lake City has 500 taps to the 1,000 population, so that the consumption per tap is only 600 gallons a day, while Charleston has only 24 taps per 1,000 people

STATISTICS OF OWNERSHIP AND CAPACITY OF WATER-WORKS. CITIES OF 50,000 TO 100,000 POPULATION.

City.	Population.	System.	Ownership.	Reservoirs.		Settling Basins.		Filter Plant.		Capacity of Pumping Plant, Gallons per Day.
				No.	Capacity, Gallons.	No.	Capacity, Gallons.	Capacity, Gal per day.	Cost.	
Lowell, Mass.	90,000	Pump to reservoir.	City.	...	30,000,000	...	...	10,000,000 to 20,000,000	$46,285	44,000,000
Nashville, Tenn.	87,500	Pump to reservoir.	City.	1	51,000,000	...	...			30,000,000
Grand Rapids, Mich.	85,000	Pump to reservoir and standpipe.	City.	1	6,000,000	...	...			30,000,000
Cambridge, Mass.	81,643	Pump to reservoir and gravity.	City.	1	5,000,000	...	...	...	...	23,250,000
Memphis, Tenn.	80,000	Pump to standpipe and direct.	Private.	....	.....	...	...	...	...	30,000,000
Des Moines, Iowa.	65,000	Pump to standpipe and direct.	Private.	...	.....	...	...	...	...	11,000,000
Evansville, Ind.	65,000	Pump direct.	City.	....	.....	...	...	...	...	8,000,000
Troy, N. Y.	65,000	Pump to reservoir and gravity.	City.	5	More than 500,000,000	...	...	...	...	10,000,000
Charleston, S. C.	64,000	Artesian wells.	Private.	2	10,000,000	...	...	...	...	5,000,000
Lynn, Mass.	62,000	Pump to reservoir.	City.	4	1,167,265,193	1	25,000,000	...	...	...
Hartford, Conn.	60,000	Gravity.	City.	6	2,000,000,000	...	...	...	...	...
Dallas, Texas.	60,000	Pump direct.	City.	....	500,000,000	2	135,000,000	...	...	30,000,000
Trenton, N. J.	57,458	Pump to reservoir.	City.	....	20,000,000	...	...	60 x 100 ft.	...	10,000,000
Manchester, N. H.	55,000	Pump to reservoir.	City.	2	19,000,000	...	...	...	...	16,000,000
Lawrence, Mass.	54,000	Pump to reservoir.	City.	2	40,000,000	...	...	5,000,000	69,532	10,000,000
Springfield, Mass.	51,534	Gravity.	City.	5	2,304,762,000	...	...	...	...	...
Augusta, Ga.	50,000	Pump to standpipe.	City.	..	.....	1	100,000,000	...	...	10,000,000
Birmingham, Ala.	50,000	Pump to reservoir.	Private.	3	143,500,000	...	...	...	...	...
Covington, Ky.	50,000	Pump to reservoir.	City.	3	110,000,000	...	...	...	...	10,000,000
Erie, Pa.	50,000	Pump to reservoir and standpipe.	City.	1	34,000,000	...	...	...	...	20,000,000
Salt Lake City, Utah.	50,000	Gravity.	City.	5	8,875,000	2	1,500,000	...	...	...

City.	Consumption.		Miles and Size of Mains.		Pressure.		No. Hydrants.	No. Taps.	No. Meters.	No. Fountains.	No. Water Troughs.
	Average per day, Gallons.	Per capita.	Distributing.	Supply.	Ordinary.	Fire.					
Lowell, Mass.	7,000,000	80	185 miles of	½ in. to 30 in.	60	60	1,039	9,686	3,232	25	23
Nashville, Tenn.	12,204,576	140	64 5 miles of	3 in. to 36 in.	30 to 100	30 to 100	520	8,140	1,925	.....	5
Grand Rapids, Mich.	.....	.....	118 miles of	4 in. to 30 in.	20 to 70	20 to 70	1,109	7,100	500	.....	31
Cambridge, Mass.	6,602,142	72	125 miles	.....	25 to 50	25 to 50	859	12,681	346	22	.....
Memphis, Tenn.	14,320,000	179	70 miles of	4 in. to 36 in.	50	50	400	3,700	400	.....	6
Des Moines, Iowa.	3,000,000	46	82 miles of	4 in. to 24 in.	100	130 to 150	910	5,000	2,100	.....	20
Evansville, Ind.	6,500,000	100	60 miles	.....	35 to 40	80 to 100	425	5,000	6	4	25
Troy, N. Y.	9,555,000	147	58 miles	3.2 mi. 30 in.	40 to 100	40 to 100	748	Over 6,000	269	..	.....
Charleston, S. C.	1,500,000	24	30 miles of	4 in. to 20 in.	20	40	460	1,500	20	2	9
Lynn, Mass.	4,360,142	68	221 miles	.....	50 to 60	45	786	11,700	1,206	2	25
Hartford, Conn.	7,500,000	125	85 miles	10 miles.	85 to 50	.....	621	7,771	464	..	8
Dallas, Texas.	4,100,000	68	58 2 mi. 4" to 24"	2 8 mi 36 in.	65	90	372	3,000	11	.....	13
Trenton, N. J.	3,500,000 in '90	64	71 miles	.....	30	.....	3 9	9,000	.....	.....	.....
Manchester, N. H.	8,500,000	68	85 miles	.....	60	60	672	5,000	2,520	10	28
Lawrence, Mass.	8,005,624	58	114 miles of	¾ in. to 30 in.	69 to 70	69 to 70	542	11,000	3,000	16	.....
Springfield, Mass.	4,638,960	90	123 miles of	¾ in. to 36 in.	30 to 120	30 to 120	793	7,900	2,207	11	11
Augusta, Ga.	3,841 993	77	52 2 miles of	4 in. to 20 in.	40	60	395	2,250	62	15	10
Birmingham, Ala.	10,000,000	200	70 miles of	1½ in. to 30 in.	80 to 100	80 to 100	244	4,000	350	.....	.....
Covington, Ky.	2, 00,000	50	48 miles	.....	112 to 123	112 to 123	.....	4,500	1,094	.....	.....
Erie, Pa.	5,500,000	110	93 miles of	1 in. to 30 in.	0 to 100	0 to 100	490	12,000	152	2	6
Salt Lake City, Utah.	15,000,000	300	125 mi. 3" to 24"	8 mi. 36 in.	90	90 to 150	900	25,000	0	25	15

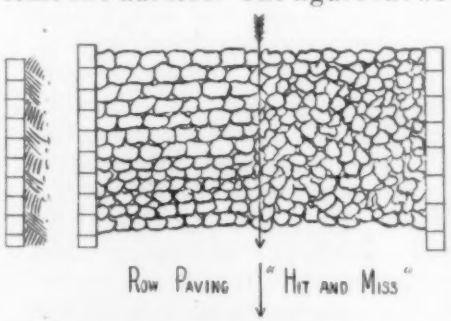
and uses 1,000 gallons per tap per day. The cities between these extremes present all varieties of condition and there is no connection apparent between the various items of consumption, number of taps, number of meters, etc.

The data are for the year 1895 and are a portion of those obtained in answer to a circular letter sent to the officers of city water-works throughout the country. A table giving the same items for cities over 100,000 inhabitants precedes, and one giving the items for cities of less than 50,000 will follow. Also tables giving financial data and comparisons of water rates will be given.

GERMAN "HIT AND MISS" PAVING.

By Robert Grimshaw, C. E.

Where the material is lacking for good block paving, as is very often the case, then there are often resorted to two forms of "hit and miss" work; one pure and simple, without plan or pattern, and the other in the semblance of a block pavement. In this latter case, which is one of the most common in German towns, care is taken that the rows do not extend clear across from border to border, but interlock somewhat. It is adapted both to cobbles and to stones having at least one flat side. The figure shows



it on the left-hand side. Such paving is done either with broken stone or with quarry stone, but in Germany very seldom with round cobbles proper, first because they are less common, and second because a town would be sunk very low, even in its own estimation, if it resorted to such material. The laying is done on a gravel bed, as carefully as though the surfacing was of cubical hewed blocks.

Much more common than this is the "hit and miss" method (shown at the right hand side of the figure) and in which no attempt is made at rows, partly because of the character of the material, partly by reason of the expense. It is usually known as "mosaic" or "row" paving. The stones used are of not more than 275 square centimeters, equal say 43 square in their face area, and in no dimension more than 25 cm.=10 inches, and not varying more than 5 cm.=2 inches. They are laid with their flattest face upwards. Their weight must pass through their center, and the stones must touch closely, but "side and side," not angle to side. This "mosaic" work is seen sometimes as carefully done as our block paving is; as far as possible stones of the same area occupying the center stripe, so that if unequal sinking occur the change in the road-cross profile will be general and not local. If the largest stones are placed in the center, where there is most and heaviest traffic, there is less chance of the cross profile altering. The common method in America, however, seems

to be, if any distinction whatever is made, after rough-sorting the stones, to put the largest at the edges, and the result is that the crown soon gets lost; then the surface drainage is gone and seepage ensues. This softens the bed and gives occasion to further sinking and inequality, which again causes local puddles where the stones are lowest, and greater softening here than elsewhere, thus increasing the evil just where it is most harmful, and so on.

If the street is not very wide it is the common custom in Germany to put those stones which joint best where the heaviest loads and the most traffic come. In the very narrowest streets there is a strip about forty inches wide of the smallest stones down the center line, then about the same width of the best stones, each side, and then again small stones to the foot-way (if there be one, which is not always the case in old towns*), the borders again being of large stones —the largest to be found. In all cases the stones should be sorted for size before commencing to pave.

For one square meter (say 1.19 sq. yd.) of such paving, there is needed 0.15 to 0.17 cubic meter (say 0.16 cu. m. or 0.21 cu. yds.) of stone. This makes, say, 0.175 cu. yds. per sq. yd.

It is to be remarked that a rough pavement (say one of stones picked up generally, or of quarry stone) demands from 1.1 to 1.3 more stone than the above, and for the best quality of paving the excess demanded runs from 0.25 to 2.00 times the net quantity.

In large cities (and in small towns in streets where there is much traffic) there is employed a combination of row paving and "hit and miss." The center of the streets, which gets the most and the heaviest wagons, is given a strip of "row paving," while on each side, clear to the gutter, there comes a band of "hit and miss" or mosaic. But the gutters, themselves, are laid with regular cubical blocks. This combined system is highly recommended and much used, but when the material is lacking or too expensive, the "hit and miss" is used.

Such a pavement is seen in Stettlin (Prussia). In the center there is a band 6 meters (say 20 feet) wide, of granite cubes, with a crown; then one meter (say 40 inches) each side of this comes broken granite. Then, again, on each side prism-shaped granite blocks about 40 inches wide and forming the gutter also. The border of this last is of granite slabs 0.16 meter equal say 6.4 inches wide and 0.40 m. equal say 16 inches long.

Wilhelmstrasse, Berlin, was formerly laid with another combination. Here there were two lengthwise strips of large stones, say 0.4 meter equal 16 inches wide and 0.6 meter equal say 24 inches long, forming separate wagon tracks, between which was a strip, partly of row paving and partly of "hit and miss."

* By an "old" town I mean one say from 500 to 1,000 years old; not mushrooms of only two or three centuries.

FORMS OF CLIP AND BRIQUET FOR TENSILE TESTS OF CEMENT.

No. III.

By L. C. Sabin, Assoc. M. Am. Soc. C. E.

The conclusions to be drawn from the two series of experiments described in the December and January numbers of MUNICIPAL ENIGNEERING are as follows:

1st. When using the ordinary form of clips with metal gripping points, the briquets which break at the places of contact of the jaws give higher apparent strengths than those which break at the smaller sections.

2d. A rubber cushion between the briquet and the jaw of the clip prevents clip breaks, but materially lowers the stress required to break the briquet.

3d. The form of clip designed by Mr. S. Bent. Russell gives somewhat less irregular results than are obtained with the Riehlé rigid clip, and although the strengths obtained with the Russell clip in its present form are a trifle lower than those given by the Riehlé, it seems probable that these lower results are due to defects in detail which may readily be eliminated.

4th. By the application of the gimbal principle to cement testing clips, higher, as well as more nearly uniform results may be obtained.

5th. In usingthe rigid form of clip, careless manipulation in adjusting the briquet may result in serious error due to the introduction of cross strains, while with either the S. G. or evener clip slight deviations in adjustment are not important.

6th. With the form of briquet recommended by the committee of the American Society of Civil Engineers, the breaking stress may be somewhat increased, and the number of clip-breaks may be very materially decreased by such a modification of the clip as to allow grasping the briquet nearer the head.

7th. As this form of briquet does not permit widening the jaws beyond about $1\frac{7}{16}$ inches, and as the experiments do not show that further widening would not be advantageous, it is quite possible that with the present form of head the full strength of the smallest section can not be developed.

Concerning the cushioning of the gripping points, Mr. W. R. Cock has devised a clip, the points of which consist of steel pins covered with small rubber tubing. This clip has been adopted in some laboratories, but, although several statements have been made concerning the greater regularity as to the place of fracture of briquets broken with it, the writer has not seen any series of tests which permit of comparing the breaking strengths given by this style with those obtained by the "Engineers' Standard." It is probable that some of the users of the "W. R. C." grip have made such a comparison but have not as yet made the results public. It is possible that when the cushion is applied in this particular manner, the breaking strength is not lower than that given by the solid gripping points. When a briquet breaks at other than the smallest section, it is certain that the smallest section

has a greater strength *per square inch* than is indicated by the result obtained; how much greater can not be ascertained. But it follows from this that if clip-breaks were eliminated in a proper way, instead of by the introduction of cross strains or other undesirable conditions, the strengths obtained would be greater than when clip-breaks occur. The fact that a rubber cushion as applied in these tests gives *lower* strengths than those obtained with the bare points shows that this is not the proper method of preventing clip-breaks.

After having made the tests on the effect of widening the jaws, so as to grasp the briquet nearer the head, the writer found that Mr. J. Sondericker had made similar experiments. But the form of briquet used by Mr. Sondericker permitted him to carry the tests further and to determine the distance required between the gripping points in order to develop the greatest strength of the smallest section. In a paper read before the Boston Society of Civil Engineers,* Mr. Sondericker gives the following account of his experiments: the outline of the neck and bearing surfaces of the briquet "consists of circular arcs of one inch radius terminated by straight lines tangent to them, and having a slope of one to two with the axis of the briquet. The sectional area at the neck is one square inch. The clips first in use had flat bearing surfaces having the same slope as the sides of the briquet. They came in contact with nearly the whole of the flat portion of the sides of the specimen, leaving a free space of about one inch between their points. Upon trial it was found that quite a large percentage of the fractures occurred at the edge of the clips. The following experiment was then made: four narrow thin strips of steel were inserted between the clips and briquet, so that the briquet bore upon these strips instead of upon the surface of the clips. It was found that as the strips were moved farther away from the neck of the specimen the number of fractures occurring outside of the smallest section diminished, and at the same time the breaking strength increased, until, when the strips were placed two inches apart, nearly all the fractures occurred at the smallest section. Two inches was therefore selected for the distance between the bearing points of the clips for this form of briquet."

FIG 5

The distance referred to above is that between the two bearing points of the clip located on the same side of the briquet. This makes the distance between opposite gripping points about 1¾ inches for the form of briquet used by Mr. Sondericker. This briquet is shown in Fig. 5.

The tests which have been considered above suggest certain modifications in the molds and clips which are now in common use in making tensile tests of cement; and although the writer believes that different forms of apparatus should not be adopted as standard until they have been thoroughly tested, yet he feels no hesitation in suggesting such changes as appear to be indicated by tests with the present form.

It is sometimes intimated that the present methods of testing should not be changed in the slightest detail, because of the fear that such a change would render the large amount of data already

*Journal of the Association of Engineering Societies, June, 1888.

collected useless for future comparisons. But cement testing methods have not reached that point of uniformity and perfection where improvement must not be sought.

Some of the desirable features for a briquet may be stated as follows:

1st. The smallest section should not have an area much less than one square inch. Probably an area of five square centimeters would represent a minimum.

2d. The area of the section of the briquet between opposite gripping points should be about one and three-fourths times the area of the smallest section.

3d. The curve of the sides of the briquet at the breaking section should not be very sharp; one-half inch might be taken as a minimum radius.

4th. The area of the vertical section of the briquet from the gripping point to the plane of the end of the briquet—the section subjected to shear when the stress is applied—should be nearly as great as the area of the neck of the briquet.

5th. The face and back of the briquet should be parallel planes to permit of easy storage.

6th. The total volume of the briquet should be kept as small as is consistent with the other conditions.

The proper form of clip should meet the following requirements:

1st. It should impart a true axial pull to the briquet without subjecting it either to cross strains or to compressive forces sufficient to cause it to break at other than the smallest section.

2d. The bearing surfaces of the gripping points should not be more than about one-fourth of an inch wide, since this is sufficient to prevent crushing the briquet at these places, and too wide a jaw will not usually bear uniformly over its whole surface.

3d. Its parts should have sufficient strength and stiffness so that they will not bend when in use.

4th. It should permit rapid operation, and

5th. It should be as light as consistent with the above requirements.

Figure 6 represents a form of briquet in which it is believed the full strength of the smallest section may be more nearly developed than with present forms. The curve at the central section has a radius of three-fourths inch, the same as that in the Am. Soc. C. E. form, but the line of the sides of the briquet is continued in a tangent one inch in length, having a slope of one to one and a half with the axis of the briquet. The corner of the briquet is formed by a circular curve having a radius of $\frac{21}{64}$ inch. The total length of the briquet is $3\frac{3}{4}$ inches, the ends being formed by straight lines tangent to the curves forming the corners. If the clip is so formed that the gripping points bear at the centers of the one-inch tangents forming the sides of the briquet, the distance between opposite gripping points will be $1\frac{13}{16}$ inches. The volume of this briquet is about 72 per cent. greater than the Am. Soc. C. E. form, and about 18 per cent. less than the form suggested by Mr. Sondericker. This style of briquet will, it is thought, satisfactorily answer the requirements stated above. The comparatively large volume is its objectionable feature, but it would seem that this is unavoidable. If the mortar is gaged in a machine mixer or with a hoe in a narrow box with sloping bottom, an amount of mortar sufficient

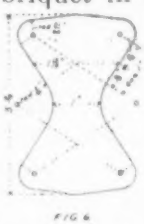
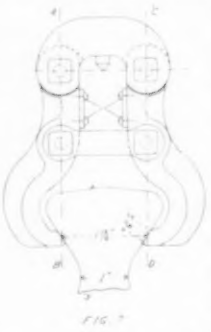
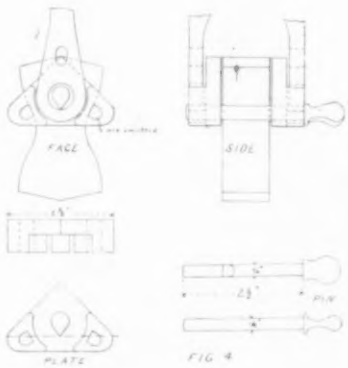


FIG 6

for five briquets can be mixed at one operation. If it is desired, however, to retain the smaller size of briquet, then a form similar to this but having an area of smallest section of five square centimeters, the other dimensions being reduced proportionately, might be adopted, and the desirable features mentioned above would still be retained.

The form of clip which is submitted for consideration is represented in figure 7. The evener form devised by Mr. Russell has been selected for modification. The S. G. clip would more nearly fulfill some of the requirements, and, so far as the principle is concerned, this form is still considered an excellent one. But no method of applying the gimbal principle has commended itself to the writer as affording such rapid manipulation as does the evener motion, and since it is thought that either the S. G. or evener form will obviate cross strains in a plane parallel to the face of the briquet, the latter form has been adopted on account of convenience. The defects in detail of the Russell clip which have already been mentioned have been obviated in the present form. The gripping points are one-fourth inch wide, a little more material has been used between the gripping points and the first pin to stiffen the clip, and the centers of the two pins and the gripping point on one side of the clip are in a straight line which is parallel to the corresponding line on the other side of the clip.





[Omitted in January number.]

THE CHEMICAL RELATIONS OF ASPHALTUM.

No. VI.

By S. F. Peckham.

I am aware that it is claimed that the first asphaltum pavement aid in the United States was laid in front of the city hall in Newark, N. J., in 1870. Natural roads of asphaltum for short distances had been known in Southern California for an immemorial period prior to 1870. It was only a step from those to streets of asphaltic mastic, as there was an abundance of material with which to construct them at tide water on the coast above Santa Barbara. I do not know, and I doubt if any one now knows, when this material was first used. When I visited the locality in June, 1866, I was told that the natural, silicious asphalte, containing about 50 per cent. of very fine sand, consisting of quartz and pulverized shale, was much to be preferred to any artifi-

cial mixture that could be prepared from a purer asphaltum and sand. Streets have been laid in the Pacific Coast cities of asphaltic mastic made with both the silicious asphalte and asphaltum with varying success. Methods for mixing asphaltum and sand have been greatly improved since 1866. Frost does not trouble them in that region, but the streets have, in some instances, been spoiled by laying in wet weather and from other causes. Having lately visited that coast I am prepared to testify that the technology of asphalt paving that has grown up there from a local center has resulted in giving to Santa Barbara a magnificent avenue, and to San Francisco and Los Angeles many asphalt streets as good as the average in any American city.

There is no doubt that DeSmedt laid the first asphaltic mastic street that was laid in any Atlantic Coast city, in front of the city hall in Newark in 1870. He was a Belgian by birth and had learned the technique of asphalte pavement in Paris before he came to the United States in 1861. As French was his mother tongue, he knew, or ought to have known, all that DeCoulaine and Malo knew at the time he left Paris. There was no asphalte, good or bad, to be had on the Atlantic Coast. Even Trinidad pitch was very little known at that time. Grahamite or Ritchie mineral, from Ritchie county, West Virginia, and Albertite from New Brunswick, with Cuban Chapapote, all pure or nearly pure, hard and dry asphaltums, were practically all of the bitumens available. There were no natural malthas, resembling Bastennes tar, to be had with which to soften these asphaltums. The only materials at hand were coal tar, which was well known to be unsuitable, and the refuse of the petroleum refineries, that thirty years' experience in France had then proved to be but little better. In spite of these difficulties, it is reasonable to suppose that DeSmedt succeeded in laying the first street in 1870 of an asphaltic mastic, consisting of sand, pulverized limestone, petroleum residuum and asphaltum of some sort, probably Trinidad pitch.

Between March 1, 1870, and February 7, 1871, DeSmedt took out seven patents. The first covers the use of coal tar and Ritchie mineral or Albertite; the second, the use of Ritchie mineral or Albertite for the purpose of hardening Trinidad or other soft asphalts; the third, for the combination of petroleum oil or residuum, Ritchie mineral or Albertite and sand, gravel or broken stone; the fourth, the laying of asphalt roads, by means of alternate layers of sand and asphalt and sand mixed; the fifth, the combination of hard and soft natural asphalts, mixed with suitable proportions of sand and pulverized stone; the sixth, the combination of "Grahamite petrolene and Grahamite Albertite," and the same combined with sand or powdered limestone; the seventh, the combination of "hydrated lime, roasted brick clay or pulverized soft brick with heavy petroleum or the residuum of the same and Grahamite or Ritchie mineral with natural asphalt and sand, gravel or an equivalent substance."

Two of these patents, the third and fourth, were reissued in 1880 with extended claims that practically covered all of the seven patents issued in 1870 and '71. There was nothing new added except the term "paraffin series," which may from the manner of its use be interpreted to be either an alternative or equivalent phrase.

It would be interesting to know

the details of the history of De Smedt's first pavement, just what went into it and how long it lasted. An examination of these patents shows that they cover the preparation of an asphaltic mastic, such as had been well known in France for at least twenty years, from such materials as were then on the market in the eastern United States. They cover the application of a well known process, which DeSmedt must have learned in all its details in Paris, to new materials. It is not likely that he used either Grahamite or Albertite, as they were comparatively very expensive, and by the middle of the 70's the deposits had both been worked out. He probably used Trinidad pitch and petroleum residuum—the same materials that have since been used. His claims for alternate layers of sand and mastic and pulverized brick and clay are of no practical value.

DeSmedt was probably the man of all others in the United States best qualified to successfully fill the position to which he was appointed about 1877 as inspector of asphalts and cements for the city of Washington, D. C. He there had an opportunity to use the technical knowledge and skill which his Paris training had given him, and to instruct a number of men in the art of laying streets of asphaltic mastic in such a thorough manner as to render the laying of such streets a commercial success. I have seen nothing from De Smedt's pen that gives any evidence that he was an educated chemist. The claims of his patents show that he was, like his instructors in Paris, an experimenter, working by rule of thumb.

Soon after the successful laying of asphalt streets had been demonstated in Washington, a street was laid in Buffalo, N. Y., under conditions that demand the most careful consideration. I refer to Linwood avenue. I know from careful personal inspection that this street is, after nearly twenty years of service, one of the best asphalt streets in the United States. It was laid about 1878 by a gentleman by the name of Abbott, with Trinidad pitch and "wax tailings" furnished by Cyrus M. Warren. Mr. Warren was one of the most capable, original and accurate scientific investigators who has ever studied bitumens. After many years' acquaintance with him I have no question that before he bought up the wax tailings, which were then a refuse product about the petroleum refineries, he had secured convincing experimental proof that Trinidad pitch fluxed with wax tailings would make a good street. They did make a good street. At that time the discovery had not been made that there were two deposits of different kinds of pitch in Trinidad; for that reason no one now knows whether the pitch was lake or land or a mixture of the two.

In correspondence with Mr. Abbott I have learned that the pitch used was a good quality of refined pitch, fluxed very soft with wax tailings and laid in the usual manner. He said it was laid so soft that during the first season of its use complaints were very general from the property-owners along the street. It was so soft that the wheels of even a light buggy would leave an impression. It gradually became compacted and firmer until for many years it has been hard without any cracks or other indications of disintegration.

Refined Trinidad pitch fluxed with wax tailings becomes a homogeneous chemical union of ele-

mentary constituents, the ingredients mutually dissolving each other, and forming with the fine sand a uniform structure of uniform strength and tenacity.

I have elsewhere discussed the principles underlying this problem. They depend primarily upon the fact that refined pitch and wax tailings mutually dissolve each other. The same principle underlies the use of Bastennes tar and natural malthas, which were long ago demonstrated by the French technologists as the most suitable materials with which to soften or flux paving asphaltums.[1]

[1] Am. Jour. Sci. (3) xlvii, p. 28, January, 1894; MUNICIPAL ENGINEERING MAGAZINE, August, 1894.

THE MODERN STREET RAIL AND ITS RELATION TO PAVEMENTS.

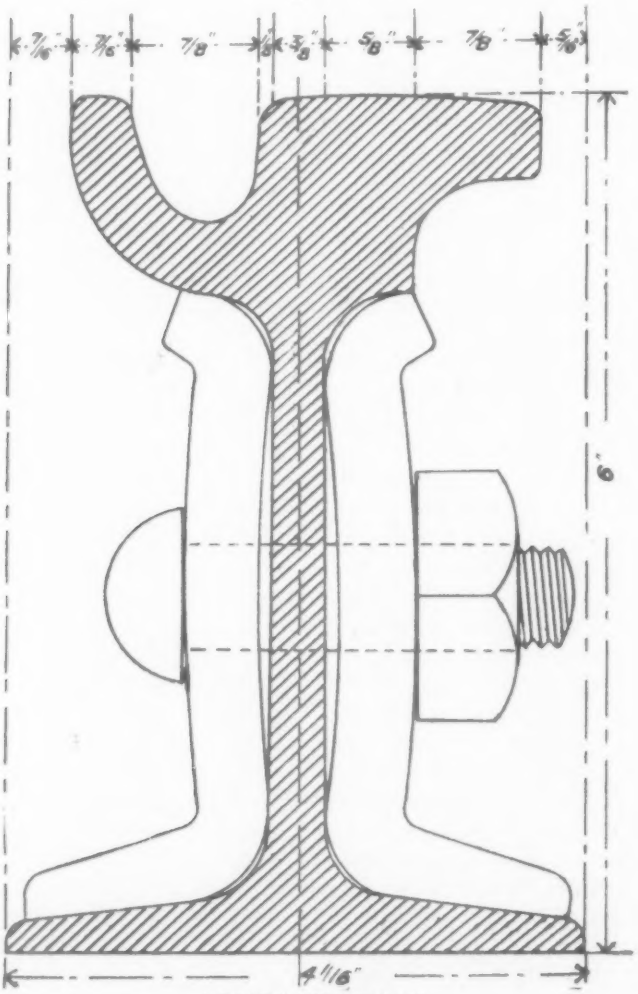
By J. W. Howard, C. E.

The form, size, and material of street railway rails are subjects of ever-increasing importance. Taken in conjunction with the methods of laying their foundations or other setting, nothing is more essential to the permanent success of street railways and the proper maintenance of pavements than a proper rail. With the increased weight of electric and cable cars, the consensus of opinion is that experience has shown that a deep girder rail is most efficient and economical if properly set on concrete, or its equivalent. It does not yield vertically and laterally, thus not only facilitating the passage of the cars upon it, but also, as far as movements are concerned, reducing the injury to the adjacent pavement to the minimum. The jarring or slight vibration has not yet been fully overcome, but upon well-constructed street railway lines of Paris, Berlin and London, as well as a few in New York, Washington and elsewhere, this vibration has almost disappeared.

The universal practice of Europe has demonstrated that the surface of the rail should be flat, and contain a groove for flanges of the wheels of the cars. Washington city, as well as a few instances in Boston, New York and elsewhere, show that the grooved rail is making steady but slow progress in America. Its only enemies, and all things considered, unjustly so, are found among the managers or employes of street railway companies which take the narrow view that if there is no groove their cars can be more easily propelled and their earnings facilitated. Careful investigation has again and again shown that wagons and ordinary vehicles upon street railways of antiquated forms, finding it difficult to turn out, delay cars more than any slight obstruction which a street railway company might encounter in the form of ice or dirt permitted to remain in any portion of the groove.

The expense of maintaining pavements adjacent to rails, except the grooved form, is so great a burden that in cities where the pavements are maintained on streets with tracks, the few dollars annual expense for removing by a small brush or scraper at intervals, accumulations in the groove amount to nothing compared with the

hundreds of dollars necessary to maintain pavements of granite, asphalt, brick or any other material adjacent to the objectionable forms of rails known as T, center-bearing, or side-bearing rails.



MODERN STREET RAIL.
DESIGNED BY J. W. HOWARD, C. E.

City engineers are all familiar with the fact that a large part of the maintenance of pavements upon streets with tracks is due to the presence of those tracks. In narrow streets these tracks cause often one-half the expense of maintenance. Mayors and boards of aldermen are steadily recognizing this fact, and, as opportunity occurs, they arrange that the expense must be borne by the street railway companies. In too many instances in our American cities the street railways pay but a tithe of the expense they should bear.

Good things at first come high, but their maintenance is not ex-

pensive. Cheap tracks or wood and poor forms of rails cause great expense in a few years. As soon as the newspapers and public in our cities discover that they are paying a large part of the bill each year in connection with street pavements, which should be paid by the railway companies, they will find it caused by the poor forms and settings of the rails now in use. The city engineers will then be sustained by the legislative bodies of our cities, in their demands for a properly designed grooved rail, correctly set, also certain other provisions easily discovered upon investigation of street railway companies and their workings.

Examinations of street pavements and street rails, which I have had occasion to make at intervals during the past fifteen years in European and American cities, convinced me of the importance of gathering data, not only in regard to pavements, but also concerning rails. I therefore have ventured to design a girder rail, which is an attempt to embody that which experience seems to have shown to be most efficient, most economical, and best from the standpoints both of the administration of the pavements and the street railways of cities. I have tried to avoid the objectionable features of many rails. The measurements are given for the benefit of street railway superintendents and city engineers, as well as those steel rail manufacturers who may chance to see the accompanying cut, with the hope of thus making it of more practical value. This cut is published with the hope that it will be an incentive to a more rapid introduction of some form of good grooved rails in more American streets — a form which will help in the problem of better pavements and their proper maintenance.

BRICK PAVING IN SMALL TOWNS.

*By A. W. Smith, City Engineer of Kokomo, Ind.**

Just how long it will take to educate the people (and some of the council) up to the fact that streets must be maintained, I do not know; I think some people seem to have the golden streets of the "New Jerusalem" in mind, and are disappointed when they find not their like on earth—perfect and with no need of repair.

Show me a city where the council or board of public works are indifferent as to what kind of an improvement they have, or too penurious and short-sighted to put in good, permanent improvements, who are always suggesting that a little patching here and there will do, or, if they finally consent to building a new street, make it a cheap improvement that will soon call for eternal patching—show me such a place, and I will show you a place that can not hold her own progressive, public-spirited business men. They are sure to go to a more wide-awake town, and surely, desirable business men seeking a new location will not select a place that is away behind the times.

One of the best reasons for having good paved streets is that they may be kept clean. There is no estimating how much disease is prevented by having well paved streets that can be, and are, swept clean.

* Condensed from paper read before Indiana Engineering Society, January 7.

Who ever heard of sweeping the filth that accumulates on macadam or other rough streets? That would be impossible, so it is left—manure, banana peel, expectoration of humans with consumption and all kinds of diseases, with other innumerable and unmentionable filth—all is left for us to inhale in the dust that is blown about, and which might be largely prevented if streets were properly paved and kept clean. So, from a sanitary reason, if no other, we should have well paved streets. There is nothing that adds so much to the appearance of a place as fine streets. We realize this in our own city. The improvements that have been put in the past season have made our city look like another place. Now that they are in, everybody is pleased with them, even those who had to pay for the improvement. I think we all hold our heads a little higher, and feel we have made a long stride forward.

Our small cities have not the wealth to afford granite, neither have the traffic to require it; but, on the other hand, it is not well to throw away money building macadam or poor brick streets, when there is a happy medium. I think the ideal pavement for small cities, and many streets in large ones, can be found in a good vitrified brick. The rapid development in brick paving in the last few years shows that it has passed the experimental stage, and is being recognized by those in authority as a very satisfactory pavement.

Prof. J. B. Johnson, of Washington University, St. Louis, Mo., says "he finds paving brick to be stronger than granite; he has tested brick as high as 30,000 pounds pressure to the square inch, the strength of granite being 12,000 to 18,000 pounds." In addition to this, the fact that a brick pavement is one of the cheapest, as well as one of the easiest repaired, is clean, and gives good foothold for horses, make it a desirable material.

In selecting brick, it is the easiest thing in the world to get the kind you don't want; especially if the right of selection is left with the entire council. There are always many manufacturers competing, and their agents are often sweet talkers. They all have equal chances to impress the councilmen with the idea that they have the only satisfactory brick in the market, and when there are so many judges there is sure to be a difference of opinion, regardless of the fact that some of them know very little about the matter. I like the idea of the Illinois Society of Engineers and Surveyors, of appointing a committee on standard tests.

Some think that to require a maintenance guarantee adds to the cost of the pavement, in order to cover probable cost of repairs during the term of guarantee. I think an experienced contractor is not likely to bid on a brick that will not stand, for he must bid so as to meet competition; therefore, he can not afford to be at large expense for repairs during a term of guarantee.

It is of the greatest importance that the contractor shall be a reliable business man; especially if the contract extends over several streets, for the engineer and committee can not be every place all the time. Not only should the contractor be competent and reliable, but his superintendent also, for this will, in a large measure, make or mar the improvement.

In putting in new pavements great care should be taken with the drainage; this should be placed near the curb. The sub-grade should be thoroughly rolled with a heavy

roller; all soft, or spongy places not affording a firm foundation will be dug out and refilled with broken stone, making a good sub-grade on which to place the concrete. I think concrete is the only foundation to use in any locality. We have found it satisfactory with us; in fact, where the sub-grade is composed of nineteen kinds of soil (as with us) in every fifty feet, no other kind will do. Especially on a made grade will you find concrete more satisfactory than any other foundation.

The grading is done when the ground is practically dry, and you can not detect all soft or unsound places; if gravel is used for the foundation, moisture from capillary attraction will cause it to go down, leaving a depression in the pavement; when the foundation is made of broken stone, the sand cushion will in time work down, and also leave a depression.

Two inches of sand for a cushion will give a smoother surface to the finished pavement. In rolling, it gives a better chance to overcome the difference in thickness of brick, The past season we only used 1½ inches of cushion, but next time I will recommend the use of 2 inches. It is a poor engineer who can not improve each year over the last.

Upon this cushion lay the best vitrified brick to be obtained; one that is hard and tough; lay them edgewise and at right angle with the curb, except at street intersections, where they should be laid at an angle of about 45 degrees.

We used a cement filler the past season, but can not tell how satisfactory it will be. A space an inch wide between the curb and brick filled with pitch, also a line about every fifty feet across the street, is said to prevent the disagreeable rumbling. I shall investigate this matter more fully.

AWARD OF PRIZES FOR WATER-WORKS BLANKS AND RECORDS.

The publishers of MUNICIPAL ENGINEERING, in the October number of the magazine, invited competition from officers and employes of water-works companies in the United States and Canada, for the best and most complete set of accountant forms and office blanks for use in conducting the business of a water-works company, suited to cities of from 10,000 to 150,000 population. The prizes offered were, for the first award, a new first-class 1896 Waverley bicycle, price, $85; secondly, a fine new oak roll-top office desk, 56x50x30 inch in size, price, $34; third, subscription to MUNICIPAL ENGINEERING for six years. The conditions of the award were as follows:

1. All sets of blanks and forms entered for the competition must reach MUNICIPAL ENGINEERING COMPANY on or before December 1, 1896.

2. All blanks and forms entered for the competition shall become absolutely the property of MUNICIPAL ENGINEERING COMPANY.

3. If, however, none of the sets of blanks and forms submitted is deemed of sufficient merit, no award will be made and all will be returned.

4. All things being equal, preference will be given in making awards to competitors who are subscribers, or the employes of subscribers to MUNICIPAL ENGINEERING.

Many sets of blanks were entered for this competition. They were referred early in December to the committee of awards, composed of F. A. W. Davis, president of the American Water Works Association, Charles Carroll Brown, M. Am. So. C. E. and M. Am. Water-Works

Association, and William Fortune, president of Municipal Engineering Company. The examination of the papers occupied much time, and the report of the committee was not filed till January 26th. It is given below in full:

REPORT OF COMMITTEE ON AWARDS.

The committee to which was referred the sets of blanks presented in accordance with the conditions of the competition for prizes proposed by Municipal Engineering Company, have carefully considered them in detail and as a whole, and present their report and recommendations.

The blanks arrange themselves quite naturally into six classes as follows, though in some instances the same blank may do duty in more than one class:

1. Applications for various services.

2. Permits of all sorts, and plumbers' and inspectors' reports of work done under such permits.

3. Office records, including all permanent records of the above two classes, and of bills, accounts, vouchers and other forms and items concerning the making and collection of bills.

4. Bills, notices and receipts.

5. Reports of operation, particularly reports of pumping plant, superintendent and other officers.

6. Such miscellaneous forms and blanks as have nothing in common with the above five classes.

By far the most important of these classes is the third, which includes the permanent record of all the financial operations, except possibly those included in the fifth class, which is the class where records show the economy of operation of the works. Then follow the fourth, first, second and sixth of minor importance, so far as form is concerned.

In considering the sets of blanks presented, the relative importance of the classes has been borne in mind, and excellence in the important blanks may offset inferiority or to some extent absolute lack of those of less importance.

Points of excellence are found in nearly every set, and the best forms of each class are found scattered through the entire list. In making the awards the committee has been obliged to weigh the relative values of the forms very carefully, and has made its decisions on the ground that the sets chosen contain the largest number of good forms, including some of the best. It believes that a better set than any one offered can be devised by combining the best features of all the sets.

The set offered by Dabney H. Maury, Jr., of the Peoria Water Company, Peoria, Ill., is the most complete set of forms offered, and they are nearly all of a high standard of excellence in form and matter, and the first prize is therefore awarded to Mr. Maury. The committee wishes to offer in criticism of this set of forms, the suggestion that the set is almost too complete, and contains some forms which could be dispensed with or combined with others. An unnecessary amount of paper and ink is also consumed in the printing, necessitating too much space for storage and filing. These have been considered as minor points, however, and have not materially affected the judgment of the committee. The following is the list of blanks in this set:

1. Applications.

A. Application for water and fixture rates—a form used either for new applicants who never had connection before or for others who desire to have old connections turned on by writing in the words "new" or "old" in blank space before the word "service."

B. Application for water at meter rates; can be used for old or new connections.

C. Application for water by meter under special conditions.

D. Application for service-pipe where no water is required, such as to curb line in advance of paving.

E. Application for water for street sprinkling by cart or wagon.

F. Application for water for special purposes, such as flushing trenches, mixing concrete for street or sidewalk paving, etc.

G. Form of bond to accompany applications E. and F. made with special reference to E., but can be used for F. by changing a few words.

H. Application for water for special purposes, such as fire protection, hydraulic elevators and motors or other purposes requiring large connections.

I. Application for permit for alteration or extension used when water is already on, and consumer desires to add to or change his fixtures. There are two sizes of this blank, one is used when only a few fixtures, the other when a greater number are added or changed.

2. Permits and Inspectors' Reports.

A. Extension permits, together with reports of plumber and inspector; can be used for alterations by substituting the word "alteration" for "extension."

B. Permits to set meter, with reports of plumber and inspector.

C. Reports of inspector, on application for water by meter.

D. Inspector's rating, used in cases where it is necessary to rate premises, when no permit for extension is out.

E. Inspector's report, used when necessary to draw a block, as in case of proposed main extension, prospective consumer not on line of main, etc.

F. Inspection of hydraulic elevator.

G. Inspection of private well.

H. Inspector's report of anything of interest which he sees, such as use of hose for sprinkling, water taken from a neighbor's hydrant, violations of rules, etc.

I. Plumber's notice for inspection of pipes in trench before being covered.

K. Receipt for meter in duplicate, original filed in office and duplicate kept in book.

L. Memorandum for inspectors.

M. Envelopes used in sending and receiving permits.

3. Books of Record.

A. Service permits, in which each service pipe put in is registered under a consecutive number.

B. Extension permits, in which are registered all permits issued to plumbers.

C. Water register or consumer's ledger. Accounts of meter consumers are not kept in the book, but the street, number and name is entered under proper register number, and page of meter book.

D. Meter register or meter consumer's ledger.

E. Register or miscellaneous bills, such as repairs to meters, stop cocks and boxes, turning off water, etc.

F. Register of delinquents.

G. Index by street number to register number.

H. Form used for several different books, such as foreman's day book, inventory books, etc.

I. "Turn on" book, in which all orders for turning on water are entered.

K. "Turn off" books, in which all orders for turning off water are entered.

L. Tables of monthly meter bills. All necessary tables are entered here, and in making out a bill it is only necessary to refer to the table.

M. Meter statement books, arranged alphabetically by streets, leaving proper vacant places for additions. Meters are read to the exact number of cubic feet.

N. Meters set.

O. Meters removed.

P. Register of all special permits, such as flushing trenches, brick work, using from neighbor's hydrant, etc.

Q. Expense book.

R. Record of vouchers.

S. Record of bills.

T. Cash receipts.

In addition to above, the usual journal, cash book and ledger are used.

4. Bills and Notices.

A. Fixture rate bill-head (regular quarterly).

B. Fixture rate bill-head (for part of quarter).

C. Meter rate bill-head (regular monthly.)

D. Meter rate bill-head (for one or more months).

E. Miscellaneous bill-head.

F. Sprinkling bill-head.

G. Special permits bill-head.

H. Building permits bill head.

I. Street sprinkling bill-head.

K. Deposit bill-head.

L. Ordinary bill-head, short or long.

M. Memorandum to place in bill file when for any reason bills are not made out, such as change in conditions of service, new application required, etc.

N. Postal card notice to consumer of fixture rate due.

O. Postal card notice to consumer of meter rate due.

P. Postal card notice to consumer of miscellaneous charges due.

Q. Notice of bill past due, fixture rate, meter or miscellaneous.

R. Notice that water will be turned off, if bills be not paid in five days.

S. Notice of expiration of special permit.

T. Notice to consumers who allow neighbor to take water without permit.

U. Notice to property-owners on streets which are about to be paved.

V. Notice to consumers having leaky fixtures.

6. Miscellaneous.

A. Requisition, in duplicate.
B. Order.
C. Report of materials received in duplicate.
D. Meter test.
E. Fire hydrant test.
F. Notices to fire department of hydrants turned off and on (in duplicate).
G. Foreman's transfer slip to be used when one foreman does work in the other department, so that all work done for each department will be reported by its foreman.
H. Copy of permit to open street, notice to city that work is completed, and copy of same.
I. Discharge check.
K. Tag to attach to pipes taken out on account of injury by electrolysis.
L. Order to repair stop-cock and box. Can be used for meter by substituting.
M. Cut of meter vault, with specifications.
N. Voucher.
O. Rebate voucher.
P. Notice to call for money due.
Q. Daily cash report.

5. Pumping Station Records.

A. Pumping register.
B. Standardization of thermometers. This form is used in comparing the numerous thermometers used in tests of engines with a normal glass thermometer graduated to tenths of one degree anti grade, and previously standardized by Yale observatory.
C. Standardization of pressure gauges.
D. Indicator card.
E. & F. Priming tests.

The second prize is awarded to J. R. Gray, of the Whitewater Water-Works Company, of Whitewater, Wis., for the best set of office record blanks, including the important blanks in the third and fifth classes and some forms in each class. The office record blanks are the simplest and at the same time the most comprehensive of those offered, but the series as a whole is not as complete as the first set mentioned, and it was thought that the set should receive the second prize with this special mention of its most valuable portion.

To F. H. Macpherson, auditor of the Windsor Water-Works, Windsor, Ontario, is awarded the third premium for the third best set, on account of its completeness, neatness, compactness and adaptability. It excells the first and second sets in neatness and excells the first set in compactness, and on the whole is deemed well worthy of the third place.

The committee has found many points of individual excellence which it would like to mention, but will restrict itself to recommending honorable mention of a few points only.

Mrs. J. Eyre, Denison Water-Works, Denison, Texas, should have special mention for the admirable distribution of accounts and methods of keeping them, and also engine records, resulting in a particularly comprehensive form of report to the non-resident officers of the operation of the plant.

E. H. Bissitt, Winnipeg Water-Works Company, Winnipeg, Man., should have special mention for the neatness of forms, and the form and completeness of the engine and boiler room records.

Horace W. Clark, superintendent and treasurer, Mattoon Clear Water Company, Mattoon, Ill., submits a card system of keeping applications and records of connections and changes in the same, and of keeping permits for use of water, which serve to keep all these records in compact and easily accessible form on the original cards, thus reducing the number and size of such records to a minimum, and should receive credit for applying this most excellent plan to such records.

Others who have submitted some specially meritorious forms are Dow R. Gwinn, of the Quincy Water-Works, Quincy, Ill.; Geo. B. Fales, of the Board of Water Commissioners, Troy, N. Y.; Henry C. Wallace, Superintendent of Water-Works of Salt Lake City, Utah; W.

W. Brigden, Superintendent and Engineer, Battle Creek Water-Works, Battle Creek, Mich.; Leon J. Gould, Water Registrar, Melrose, Mass.; T. B. Davis, Shreveport Water-Works, Shreveport, La., and Oscar K. Baldwin, of the Danville Water Company, Danville, Ill. The list could be materially extended if time and space permitted.

F. A. W. DAVIS,
CHARLES CARROLL BROWN,
WILLIAM FORTUNE,
Committee of Awards.

Mr. Maury was advised of the committee's award to him of first prize. In a letter in response he says:

I should state that your committee's award should not give to me the entire credit for whatever merit they may deem the forms I submitted to have. The head of each department of the works has contributed something to the total, and special credit is due to my assistant superintendent, Mr. Henry Ringness, who has, from time to time, suggested many valuable improvements.

DABNEY H. MAURY, JR.,
Supt. Peoria Water Co.

Further details regarding the different sets of blanks and records will appear in later numbers of MUNICIPAL ENGINEERING.

PROPER RELATION OF CONSTITUENTS OF PORTLAND CEMENT.

Mr. Erskine W. Fisher, of the National Building Supply Company, New Orleans, sends answers to the questions submitted by MUNICIPAL ENGINEERNIG to manufacturers as to the proper relation of the constituents of Portland cement. He says: "Although I have made a careful study of the subject for nearly thirty years, yet I have never actually been a manufacturer, and there are several technical points raised. I have referred your questions to my manufacturer in Germany, and will be pleased to give you his answers when I receive them; meanwhile I have replied to the various questions to the best of my ability. I feel that the interest you are taking in the matter of Portland cement can not be too highly appreciated, and I trust you will continue the good work. A thorough knowledge of the subject can not fail to benefit all, from the manufacturer to the consumer." The questions and Mr. Fisher's answers are as follows:

(1) What do you consider to be the proper relation among the following constituents of Portland cement: Lime, magnesia, silica, alumina, iron oxide?

Ans.—Lime, 64.00; magnesia, 2.00; silica, 23.00; alumina, 7.50; iron oxide, 2.50; sulphuric acid, 1.00.

(2) What is the allowable limit of (combined) magnesia in Portland cement?

Ans.—I should not advise over 2 per cent. magnesia, although it is possible for the percentage to run up as high as 5 per cent. without serious results. The less magnesia in a Portland cement, however, the better.

(3) Does this limit depend at all on whether the cement is to be used in sea water?

Ans.—The results would be about the same, whether sea water or fresh water was used.

(4) Is *free* magnesia more harmful to a cement than *free* lime?

Ans.—No. Both are bad except in quite limited quantities, and are liable to cause a cement to swell and finally crack.

(5) What is the allowable limit of sulphuric acid in Portland cement for use in sea water?

Ans.—Probably one to two per cent.

(6) What is the allowable limit of sulphuric acid in Portland cement to be used elsewhere than in sea water?

Ans.—The answer to the fifth question will apply to this also.

(7) Do you consider that the addition of sulphate of lime to Portland cement after burning is a reprehensible practice, and if not, what would you consider the safe limit of such addition?

Ans.—Sulphate of lime may be added to the extent of about two per cent., depend-

ing, however, upon the raw material, and is a matter which must be decided by the chemist in charge.

(8) Is alumina a desirable constituent in Portland cement and within what limits should its percentage be restricted?

Ans.—I consider it necessary, although it should not exceed eight per cent.

(9) What is the allowable limit of oxide of iron in Portland cement?

Ans.—The allowable limit of oxide of iron may be put at five per cent., but I think for many reasons it is better that it should not exceed three per cent.

THE QUESTION DEPARTMENT.

[By J. W. Howard, B. L., C. E., for MUNICIPAL ENGINEERING.]

COAL-TAR WITH ASPHALT.

Should coal-tar be used as a flux with refined asphalt for making asphaltic cement? *G. W. C., Plainfield, Wisconsin.*

Experience has shown that coal-tar must be avoided in connection with asphalt for street pavements, walks, roofs, etc. The action of the sun and weather disintegrate mixtures containing coal-tar. If a very little is present it, of course, takes a longer time to show the evils resulting from it.

WEIGHT OF PORTLAND CEMENT BARRELS AND CONTENTS.

What should be the weight of Portland cement barrels, full and empty?
M. A. R., Louisville, Ky.

A standard barrel, upon inquiry among the importers, and that upon which duty is levied, weighs, when full, including the barrel, 180 kilograms or 396 pounds. An empty barrel weighs 10 kilograms or 22 pounds. The contents, therefore, should weigh 170 kilograms or 374 pounds. It is proper, when specifying for the use or purchase of Portland cement, to specify exactly how many pounds of cement should be contained in each barrel, and although they may vary slightly, according as they come from different works in England, Germany or elsewhere, it must be remembered that if an order or specification calls for a certain number of barrels, that there is great risk of purchasing light weight barrels.

Portland cement when placed in barrels is compressed by artificial means; therefore the cubic contents of a Portland cement barrel, while important, is not the only test of the quantity of cement purchased. Attention must be given to the weight of contents in the barrel.

ASPHALT FOR BRIDGES.

What kind of asphalt paving is used for the roadway of a bridge?
G. W. Clark, Plainfield, Wis.

If the bridge is a suspension bridge or one of light construction subject to slight vibration, it is best to use an asphalt mastic, such as is used on the bridges throughout France. This mastic can be composed of melted asphalt mastic cakes or blocks as imported from Europe, to which is added a very little refined Trinidad or other natural asphaltum to facilitate the melting. Sand and a little gravel are then added. The whole mixture is stirred, spread in place the same as similar work on roadways elsewhere.

The foregoing, however, is a little too soft under wheel traffic in hot weather. Therefore, it is best, if the bridge is one of solid construction, to use the regular asphalt paving mixtures, such as are employed upon all roadways. A binder or bituminous concrete should first be laid. The whole thickness, however, is generally less than that of street pavements.

Specifications can be obtained for street pavements by addressing the department of public works of any large city or from the leading asphalt paving companies which advertise in MUNICIPAL ENGINEERING.

STREET CLEANING CHEAPENED BY GOOD PAVEMENTS.

Does paving streets with granite blocks having their joints filled with paving cement, or the use of asphalt or brick pavements materially reduce the cost of street cleaning? Is it necessary, with smooth pavements, to clean them better and thus keep the cost the same or more than with rough pavements?

New York Inspector, Harlem.

Answering the latter part of the question first, it is useless to undertake to retain filth on streets by having rough pavements. The citizens of modern cities want smooth, quiet streets and clean ones. The public would be willing to pay additional cost in many cities for such blessings. Fortunately, these blessings are cheaper than what we formerly endured. Well laid, smooth pavements, on concrete foundations, are cheaper to maintain in constant good condition than poor pavements. They are cheaper to clean, as shown by the bids received for removing snow from the streets of New York during the winter of 1896–7. The work is accomplished at twenty-five per cent. less than the previous year and at almost one-half what it used to cost before New York enjoyed the improved pavements, which, since 1889, have been so rapidly extending through the city. The cost of street cleaning, as well as snow removal, is lessened by well-paved and well-maintained street surfaces. As soon as flat grooved rails have replaced the uneven center-bearing and side-bearing rails, the pavements can be maintained in better condition than at present and the cost of street cleaning will be materially reduced.

COST OF GRANITE AND ASPHALT PAVEMENT ON FIFTH AVE., N. Y.

I have seen various statements regarding the cost of Fifth Ave., New York, granite block and the new asphalt pavement. Can you give me facts or references?

A. N. Francis, Supt. N. I. Co. Providence, R. I.

The full details are found in different issues of the official City Record, published daily by the city of New York, in connection with the annual reports of the department of public works.

The following are the facts condensed. They are interesting because of the heavy, numerous and uniform traffic on that avenue:

The granite pavement, now being removed, was laid in 1886. The portion considered is from Washington square, where the avenue begins, to Fifty-ninth street, the southeast entrance to Central Park, two and a half miles of a broad roadway. The granite pavement was laid on 6 inches best concrete, 2 inches sand, and granite blocks of exceptional uniformity, 4 to 4½ inches wide, 10 to 12 inches long, and 7 to 7½ inches deep. Joints were filled with gravel and pitch.

First cost granite on Fifth ave. per sq. yd	$4.97
Maintenance 10 years @ 11⅛ cts.	1.11
Total cost 10 years (actual)	$6.08
Further maintenance cost (estimated at same rate, although blocks being rounded would cost more to maintain) @ 11⅛ cts. for five years more	.55
Total cost 15 years	$6.63
At about the end of 15 years the entire granite block surface, gravel and pitch would have to be replaced at least cost	2.59
Grand total outlay for granite, 15 years (leaving pavement in good order)	$9.22
Deduct cost of original pavement, because with the pavement in good order at the end of 15 years, the city has it on hand as an asset	4.97
Net cost (without interest) Fifth ave. granite pavement in 15 years	$4.25

The cost of asphalt pavement under contract of 1896, was contracted for at a little less than $4.50 per square yard, but because of possible extra work it is best to regard $4.50 as the price. The contract requires fifteen years' continuous maintenance, and the pavement turned over in good condition at the end of that time. When finished seventy per cent. of the contract price is paid, and the balance at intervals until the end of the fifteenth year.

First cost of asphalt pavement on Fifth ave., (70 per cent. of bid)...	$3.15
Maintenance during 15 years (30 per cent. of bid)	1.35
Grand total for asphalt, 15 yrs.	$4.50
Deduct the value of pavement on hand, an asset in possession of the city, not quite equal to the first cost, because the pavement, although maintained in good condition, might not be regarded in every respect equal to new (therefore deduct not $3.15, but $2.90)...	2.90
Net cost (without interest) of Fifth ave. asphalt pavement in 15 years.	$1.60

It is proper to note that Fifth avenue, although subjected to a heavy traffic, contains no car tracks, which, if present, would increase the cost of maintenance of both pavements by at least twenty-five per cent. The cost of asphalt pavement upon Fifth avenue being so much less than granite, must not be construed to mean that asphalt pavement is cheapest and best for all streets. It undoubtedly is a pavement which can be maintained in constant good order cheaper and better upon many streets which persons who have not been able to examine statistics, have heretofore considered as streets for which granite alone would be best.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

VELOCITY OF DISCHARGE OF AUTOMATIC FLUSH TANKS.

Can the effect of the flushings from an automatic flush tank (flushing every twenty-four hours) be figured out?

H. Emlen, Trenton, N. J.

Flush tanks as usually designed have a capacity of 200 to 400 gallons. Larger tanks may be used when larger pipes are to be flushed, according to the size of the flushing apparatus as given in the catalogues of flush tank manufacturers. A good flushing apparatus of the ordinary size for eight inch sewer pipe should discharge ten to fifteen gallons a second, as the average of the entire time of discharge which would give an average initial velocity of three or four feet a second. A 400 gallon tank contains enough water to fill the eight-inch pipe full for a distance of about 140 feet, and the velocity of the water in the sewer as determined by experiment will be considerably increased over the velocity due to the inclination for distances of 500 to 2,000 feet according to the special circumstances. The volume of water and the increased velocity make bodies in the sewer lighter and push them forward so that the sewer is self-cleansing unless a crack or a bad joint allows the object to become fastened in it. Mr. Andrew Rosewater, when city engineer of Omaha, made some experiments on the effect of flush tanks, and states in one of his reports that a tank of a capacity of 300 to 500 gallons will produce an additional depth of water in eight and ten-inch sewers of two to three inches for distances of 700 to 1,200 feet, and gives his statement that a depth of two inches and a velocity of five feet a second will be produced at an average distance of 800 feet. The maximum

velocity of discharge of a tank, and the velocity from minute to minute, can be approximated by computation with the known head of water on the siphon.

LIABILITY FOR NOT PROTECTING OPEN TRENCHES.

In leaving trenches open in street over night, in what way must they be protected to relieve a contractor or water company from liability? In placing red lights, how close to each other on a line of trench must they be? *J. G. Hoyt, Supt., Oneonta, N.Y.*

If there is a municipal ordinance on the subject, strict compliance with the ordinance will relieve the contractor or water company. If there is no ordinance the court will decide whether the protection is sufficient. Ordinarily a light barricade at each end of the excavation and at each place of crossing, with one or two lanterns, according to the width of the obstruction, and lanterns every fifty feet along the bank of earth in the street should be sufficient. If there is no bank of earth between the trench and the roadway, more protection will be needed in the way of barricades and lights than if there is a pile of dirt to serve as a barricade. Red lanterns and oil are not expensive, nor are the ordinary light barricades, and one successful suit for damages would pay for enough material and attendance to last several years.

BOOKS ON THE CONSTRUCTION OF WATER-WORKS.

Please advise me where I can purchase a good authority on the survey and construction of water system for small city.
James Hamilton, Jr., Chester, S. C.

Fanning's "Water Supply Engineering" ($5) gives the fundamental principles and many applications to particular details of the design of water-works. Billing's "Some Details of Water-Works Construction" ($2) gives many practical details of construction. Gould's "Hydraulic Formulæ" ($1) gives methods of determining sizes of pipe. Books on surveying, such as Gillespie's, Johnson's and others, give methods of doing the instrument work. No one American book gives all the information probably desired. MUNICIPAL ENGINEERING can furnish any books desired, at list prices.

Proper Charges for Fire Protection and Other Public Uses of Water.

Mr. E. Knichling, the chief engineer of the Rochester, N. Y., water-works, has submitted two communications to the executive board of that city regarding the so-called deficiency in the water-works revenues and the credits that should be allowed the water-works. In the first letter he discusses the matter of saving in insurance premiums. From 1863 to 1873, before the introduction of the Holly system for fire protection in the central part of the city, and the gravity system from Hemlock lake over the major part of the city, the average yearly fire loss in the city was $119,245, of which the insurance companies paid $84,252, and uninsured property-owners $34,993. In the six years, from 1874 to 1879, the average yearly fire loss was $82,345, of which the insurance companies paid $70,226 and property-owners $12,119. The annual saving was thus $36,900, $14,026 to the fire insurance companies and $22,874 to the uninsured. Much of this saving must be credited to the introduction of the water supply. Another saving to the public was the reduction of insurance premiums, about 40 per cent. in 1875, amounting to quite $150,000 a year. If the insurance premiums have not again been raised the annual saving due to the presence of the water supply system amounts at the present day to at least $400,000. In the absence of actual data, refused by the Rochester insurance men, a deduction from the state insurance reports for 1895 is given to show that this figure is not too large. The premiums received in the entire state were $22,942,277 on risks amounting to $3,138,939,171, and the fire losses paid were $11,160,704. The average rate of insurance was thus 73.1 cents per $100, and the losses paid were 48.6 per cent. of the premiums received. These averages have been nearly constant for five years. The total assessed valuation of the real and personal property in the state is $4,374,770,657, indicating that 72 per cent. of it is insured. Rochester's valuation is $105,000,000. The same percentage would make Rochester's fire risks $75,600,000, and the above average insurance rate would indicate that the city paid $552,636 in premiums. If the ratio of population is used instead of the ratio of assessed valuation, the figure becomes $596,496. The ratios for the state as a whole must be smaller than for the cities, as in Buffalo where 88.7 per cent. of the assessed valuation is insured at an average rate of 75 cents per $100. Using these ratios, the annual premium receipts in Rochester would amount to $693,502. It is evident, therefore, that the city pays at least $560,000 a year in fire insurance premiums. If the amount were $600,000 the saving at the rate of 40 per cent. above given would be $400,000.

The fire department costs $210,000 a year. The water-works should have a credit of $130,000 a year for 2,600 fire hydrants. The total an-

nual expenditures for protection against fire and indemnity therefor should therefore be $900,000 a year. For the last 5¾ years the average annual payments for fire losses by insurance companies in the city have been $180,019, about one-fifth the average loss in the United States from the same number of fires (250 per year). The fire protection and indemnity cost five times the return payments, and the premiums are three times the return payments. The general average in the state is only twice the return payments for losses, and is said by some insurance men to be still less. An argument is therefore made for lower insurance rates.

It is but fair to the Rochester insurance men to state that they assert Mr. Knichling's figures to be incorrect, but they do not furnish data to correct them, and it is probable that they are incorrect only in detail, but are in the main a fair statement of the case.

Mr. Knichling's second communication to the executive board takes up the various credits that should be allowed the water-works in determining whether they are truly self-supporting or not. The water-works are a general benefit to the city at large, and to make them generally beneficial to individual inhabitants directly, as soon as possible, the rates were made low when the works were completed, with the result that nearly every citizen has direct access to the works, and other sources of water supply are practically abandoned. The works serve two purposes: to supply individuals and private corporations, for domestic and industrial uses, and to supply the general public needs, such as extinguishment of fires, sewer flushing, sprinkling and cleaning streets, supplying fountains, public buildings, schools, charitable institutions and so forth. The first purpose is individual, and should be paid for by the individual served. The second is general and of public benefit, and should be borne by the community at large. The first use is quite uniform, and can be easily provided for. The second is much greater at times, and requires reserve supply and capacity, whereby the cost is greatly increased. A fire may require 10,000 gallons a minute, which is 50 per cent. more than the regular rate of consumption and must be added to it. The enlargement in the supply and distribution necessary on this account is assumed to cost 30 per cent. of the bonded debt of the works or $1,680,000 on which the interest is $96,600 a year. This is the portion of the debt due to the Holly system, whose expense of operating is $22,400. Maintenance of hydrants and operation of Hemlock system for fire purposes costs $31,000. These three items make $150,000 a year necessary to keep up the fire service and to pay its fixed charges. The total interest on the bonded debt is $321,500, and the saving on insurance premiums (a general benefit proportional to valuation, approximately) is

$400,000. Credit for this saving would wipe out any deficiency apparently occurring. General public uses of water for buildings, schools, etc., amount to at least 10,000,000 cubic feet of Hemlock water, and 2,000,000 cubic feet of Genesee water annually, amounting at schedule rates to $12,000 a year, from which only $2,600 is derived. Street sprinkling and cleaning, ordinary small fires, and such open uses consume about 40,000,000 cubic feet of Hemlock water, and 26,500,000 cubic feet of Genesee river water annually, amounting to $42,000 and $19,875 respectively per annum, for which no credit is at present given. The above consumption is about 15 per cent. of the total annual consumption. The total annual interest charge is $321,500, and the operating expenses are $125,100, a total of $446,500, if we deduct $96,600, the interest charge on the enlargement due to capacity required for large fires, the remainder is $350,000. Fifteen per cent. of this amount, or $52,500 would be the charge to be made for the public uses mentioned. This added to the $96,600 makes the total annual charge for public uses and fire protection $149,100, very nearly the $150,000 derived in a different manner above. Again, assuming the schedule rates of 14 cents a 1,000 gallons for Hemlock water, and 10 cents for Genesee water, and allowing 10 per cent. for leakage, the annual income from the water furnished should be $486,000. The amount actually received was $336,000. The difference is the $150,000 derived above as the proper credit. At schedule rates this would pay for much more water than that assumed above to be used for public purposes. An annual interest charge of $40,000 a year on account of excess of cost of works over present needs on account of future growth of the city is deemed proper as an additional credit to the works.

When maintenance, interest, sinking fund and reserve for contingencies and additions are computed, it will be found that the works, to be self-supporting on this basis, must earn about $560,000 a year. If the public uses are not paid for by the city at large, the water rates must be materially increased, and the matter of credit for public uses of water must therefore be definitely settled by the financial authorities as a first step.

The Water Rate Question in Milwaukee.

In MUNICIPAL ENGINEERING was given in August, 1896, a review of the operation of the water-works system of Milwaukee, Wis., in 1895, showing a surplus for that year, paid into the general fund of the city, of $80,000. The city is charged $125,000 a year for general city uses, but over $112,000 of this sum was uncollected at the end of 1895, and is likely to so remain. About $48,000 seems to have been paid for public uses by the city in 1895.

In May a new water registrar was appointed, to whom the surplus paid into the general funds was ob-

jectionable, and he sent a communication to the council in August, proposing even the furnishing of free water to householders and for general city purposes, leaving the breweries, factories and business houses using meters as at present and reducing the regular rates 25 per cent. Consumers paying regular rates paid $129,612.29 in 1895, or 50 per cent. more than the surplus. Part of these are business houses and small factories, but there are nearly 18,000 meters in use, about 50 per cent. of the taps being metered, and about 30 per cent. of these meters are on factories and business houses, and 70 per cent. on residences. The private families on meter rates paid $57,702.60 in 1895. There being no minimum annual rate, nearly 500 families pay but $1.20 a year and 5,760 families pay less than $12 a year, which is said to be the average payment by families on regular rates. The average payment by 12,000 families on meter rates is less than $5 a year. It is evident that free water to householders and free water for city purposes can not both be granted at the same time. A reduction in regular rates of 25 per cent. would cause a reduction in revenues of about $32,000 a year, if applied to all payers of regular rates. The old argument, that the sewers, police, light and schools, are paid by general tax and therefore household uses of water should be, is accompanied by the demagogue's argument of employment of labor in making the extensions that would be necessary, and at the same time the free use of water for city purposes is demanded. Evidently the source from which the enormous expenses of such a system are to be derived is lost sight of and the bid for popular favor will lose its effect by its very extravagance of promise.

The water registrar and the city engineer have had some controversy over figures in which the city engineer's knowledge of facts and thorough study of the question are evident and place his statements beyond question of their substantial accuracy and applicability to the discussion of the question.

A comparison of the conditions in Milwaukee and in Rochester, N. Y., will be of value since Milwaukee is struggling with a so-called surplus and Rochester with a so-called deficiency. The following will place the principal facts in shape for easy reference:

	Milwaukee.	*Rochester.*
Population estimated, 1896	250,000	166,000
System	Pump.	Pump 1/6 Gravity 5-6
Capacity of pumping plant, gallons daily.	48,000,000	7,000,000
Average consumption gallons daily	25,291,050	1,800,000 pumped 9,000,000 gravity
Miles of distrib'n pipe	296	265
Miles of supply pipe	3·5	59 2 ft. to 6 ft. diam.
No. of hydrants	2,174	2,578
No. of taps	32,200	28,420
No. of meters	16.200	5,157
Cost of works	$4,633,435	$6,900,000
Bonded indebtedness.	1,600,000	5,600,000
Cost of maintenance, 1895	118,632	$123,000 about
Interest and sinking fund payments, per annum	$244 298 interest and s. fund.	$322,940 interest.
Receipts from water rents, 1895	$441,932	$335,000 about.
Charge to city for hydrant, etc	$125,000* a year.	$110,000
Meter rates	Graduated.	14c. per 1,000 gal. gravity.
	15c. to 3.5c. per 100 cu. ft.	10c. per 1,000 gal. pump.
Regular rates 8-room house	$15.00	$11.00
New construction	$212,000† from bonds.	$30,000 paid by city.

*Of this amount $50,000 was assessed on abutting property-owners for new pipe laid and credited back to the fund.

†Much of this is either uncollected or offset by payments to general fund from surplus. Payments to general fund were more than receipts from city in 1895.

In a preceding article in this

department will be found the argument by the chief engineer of the Rochester water-works for a charge to that city of at least $150,000 a year for water for city purposes. The same method of consideration of the additional cost of construction and maintenance would indicate that the city of Milwaukee should pay nearly or quite $125,000 a year for fire protection. The use of water for city purposes, such as street sprinkling and washing, schools and public buildings, etc., on the liberal estimate of slightly over 1,000 million gallons, at the schedule rates would amount to about $50,000 a year, bringing the total charge for public uses to $175,000 a year.

In the city of Milwaukee, evidently, there are many more people who do not use the city water than there are in the city of Rochester. Under the system practically in vogue in Milwaukee these people pay nothing for the use of water, while they are benefitted by the public uses mentioned, quite as much, in proportion to the valuation of their property, as the users of water. They also, if within reach of water mains, enjoy the reduction in fire insurance premiums, amounting doubtless to 20 per cent. on residence property, and have the benefit of the reduced risk of total loss of combustible property if they do not carry insurance.

There are three main classes of charges for water which should be assessed in different ways. The first is for the private use of water for domestic or manufacturing uses, which should evidently be made directly to the user; the second is for the general benefit to the city at large in which every citizen joins, and which should be assessed as other general benefits are, in the form of taxes. The third is for the particular benefit derived from the reduced fire loss or reduced premium for protection from such loss, which is proportional to the value of buildings and contents, and roughly proportional to assessed valuation of property. This class of charges is seldom or never taken account of, but the measurable financial benefits to the city at large are undoubtedly greater on this account than any other. An allied benefit is the increase in valuation of property on account of adjacent water mains, even if the property is comparatively unimproved. This is taken care of in Milwaukee by the assessment of a part of the cost of new mains on the abutting property, the proceeds being turned into the fund for new construction.

The "regular" rates in Milwaukee are materially higher than in Rochester and seem to be higher than in Detroit and Cleveland. The meter rates for small quantities are also higher than in these three cities.

The rate at which the debt should be paid and the assessment of this expense on consumers or on the city or partly on consumers and partly on the city at large are

points of debate on which there is no general agreement. Milwaukee is making rapid strides toward the extinguishment of its debt, being required to retire five per cent. of the original debt each year, and still some reduction at least of regular rates seems possible if the city at large bears its equitable share of the burden.

If no payment were made to the general fund, the expenditure for maintenance for 1895 would amount to $386,423. The receipts from private consumers were $415,706. If the city's share is assumed as $175,000, a large surplus would result, but if the receipts from the two sources are scaled down in the same proportion, the receipts from private consumers would be $272,000, and from the city $115,000, and the rates could be reduced one-third. If it were deemed advisable to have a surplus of say $80,000 for contingencies and to make a fund for large additions to the capacity, the receipts from private consumers should be $329,000, and from the city $139,000, and the rates could be reduced one-fifth.

It is difficult to assess the benefit of reduction in fire insurance premiums without more information than is at hand, but if we assume $410,000 of such saving, and say that half of this should be borne by the city at large, and half by the private consumers, and add this to the respective receipts above, and scale down to the basis of the actual receipts, we will have, with no surplus, receipts of about $240,000 from private consumers, and $146,000 from the city, or a possible reduction in rates of about 40 per cent., and with an assumed surplus of $80,000, receipts of $289,000 and $177,000 respectively, and a possible reduction in rates of about 30 per cent. This is very nearly the same result we would receive by assessing the city the $175,000 computed as the value of the general service, and reducing the revenue from private consumers by an amount equal to the increase in the city's payment.

Future growth in business should increase the surplus each year, unless the increase in bonded indebtedness on account of new construction is equal to the decrease on account of payments to sinking fund. The fixing of a minimum meter rate of about $50 would also cause a slight increase in the receipts.

From a consideration of the business of 1895, and the data given in that report without reference to other years, a reduction in rates of 20 to 25 per cent. would seem to be safe, and would place the rates on a par with those of other cities in similar situations, but an addition to the tax rate, to raise the additional sum required from the city funds would be necessary.

Cost of Asphalt Repairs in Buffalo. In Mr. E. B. Guthrie's paper before the last convention of the American Society of Municipal Improvements were given the general results of the system of asphalt repairs in Buffalo and the cost per yard of doing the work.

His paper appeared in MUNICIPAL ENGINEERING for November, 1896. Under the system followed it is easy to keep account of the cost of repairs per yard of pavement actually relaid, per yard of street on which work is done, and per yard of the total asphalt surface, and to keep these accounts for each year. Tables in the annual report of the department give all these accounts, one of which is reproduced with the paper referred to. This table gives the result for the cost of repairs the first year after the guaranty expires, the second year, and so on to the eleventh year, the oldest pavement now existing being sixteen years old and the period of guaranty being five years for all pavements except those laid in 1884.

The following table gives the cost of repairs per square yard per year for the pavements laid in each year since 1879. It differs from the table referred to above, therefore, in keeping the streets laid the same year together instead of putting those of the same length of time since guaranty expired together:

Year laid.	Streets paved.	Years of guaranty.	No. yards paved.	Cost of repairs per yard per year.	No. yards in streets actually repaired.	Cost of repairs per yard per year of such streets.	Years maintained.
1879	1	5	7,264	0.035	7,264	0.035	11
1880	1	5	3,755	0.019	3.019	0.025	10
1881	1	5	8,876	0.021	8.876	0 021	9
1882	2	5	25,501	0.028	25,501	0.028	8
1883	3	5	35,815	0 078	35,815	0.078	7
1884	8	8	79,744	0 046	79.744	0.046	3
1885	15	5	113,498	0.066	110,418	0 068	5
1886	28	5	286,001	0.078	203,371	0.092	4
1887	14	5	126,490	0 037	122,780	0.038	3
1888	18	5	201,668	0 030	201,668	0.030	2
1889	40	5	249,333	0 017	244,087	0.017	1

In both tables it is interesting to note the lack of uniformity in cost of repairs from year to year. Results are abnormally high in several years; for streets paved in 1883 on account of two streets requiring much repair, in 1885 on account of two, and in 1886 on account of ten poor streets. The streets paved in 1884 have been in the hands of the city only three years instead of six, on account of the eight years' guaranty required that year. One street is omitted from the tables. It was laid in 1878, was resurfaced before its guaranty expired and again in 1893. Omitting the poor streets laid in 1883, 1885 and 1886, the results shown in the above table are fairly uniform and indicate that the cost of repairing streets after the guaranty has expired is reasonably uniform when poor first construction is eliminated. The results in the table accompanying Mr. Guthrie's paper show the same, but the results for two, three, four, five and seven years' maintenance show abnormally large because they include the poor streets of 1883-5 and 1886. In other words the results in Mr. Guthrie's table show the effects of the poor streets of 1883-5 and 1886 in fair lines, those for 2, 3, 4, 5 and 7 years' of maintenance, while in the above table they show only in the lines for the three years in which the poor pavements were laid.

Omitting these years, the above table will give an average cost of maintenance per square yard per year of 2.7 cents, half the average cost (5.5 cents) given in Mr. Guthrie's table, which includes all the streets. These averages are com-

puted on the total number of yards of streets in the respective years, not on the number of yards in streets actually repaired. The effect of a few poor streets on the size of the repair bill is very marked, and the economy of good first construction is very evident. The economy of early resurfacing of poor streets is indicated very strongly. Some statistics of amount of traffic on the various streets would be of value in applying these results to other cities.

Recent Foreign Practice in Sewage Disposal.

The cities of Columbus, O., and Worcester, Mass., are discussing, one the necessity of beginning the purification of its sewage at an early day and the other the enlargement of its present operations in that direction. The daily papers of both cities contain frequent articles on the subject and give descriptions of special processes applied at various places. Among the more recent propositions and installations in Great Britain and Ireland, where sewage disposal is perhaps more generally studied than elsewhere, are those mentioned below.

Glasgow proposes a complete system of intercepting sewers, which will take the ordinary flow of sewage and a small amount of storm-water from the present sewers near their outlets and carry it nine miles below the city. Here the solid matter will be removed and the purified effluent will be discharged into tide-water in the Clyde, in such condition and at such a point that the present very objectionable condition of that stream will be materially improved.

Belfast has established two pumping stations. One with a total capacity of 3,000,000 gallons an hour lifts the whole of the discharge from the low level system, an average height of 11 feet, into the sewers of the high level system, which discharge at the second station. The pumps here have a capacity of 1,350,000 gallons an hour and lift the sewage proper a height of 9 feet into reservoirs of 5,000,000 gallons capacity, whence it is discharged into the sea at high water. No purification of the sewage is considered necessary under this method of handling.

Manchester treats its sewage chemically, but the effluent is not acceptable for discharge into the ship canal at the works. The city surveyor has recently made an elaborate report in which he details the local conditions and the estimated cost of filtering the effluent through the soil on the available land, some of which is at an elevation which would require pumping, and also, the cost of establishing artificial filters and maintaining them. He shows the excessive cost and the doubtful results of both methods with the large quantities of sewage and storm-water to be treated. He then outlines a plan for constructing an outlet sewer about 16 miles long to carry the effluent from the precipitation works to tide water and a scheme for carrying the

sludge from the works out to sea in a vessel of special design which would carry 1,000 tons of sludge. The distance out and return is about 120 miles. Nearly all the discharge of the sewerage system would thus be taken care of, the small percentage of excessive storm-water being discharged without objection into the ship canal. The first cost of this method is less than half that of either of the others and the cost of maintenance but a small fraction and the result is unquestionable.

The smaller city of Hamilton, Ontario, after a consideration of the advisability of collecting all the sewage from the numerous outlets, and discharging it into the bay at one point far removed from the city water front, has decided that the first cost was too great and the future nuisance too probable to warrant the adoption of the plan. It is therefore proposed to collect the sewage at two points of discharge and purify it by chemical process, carrying the effluent to the waters of the bay, where it will be comparatively unobjectionable if the purification is not complete. The works at one outlet are now nearing completion and consist of the usual precipitating tanks, power-house and sludge press. The chemicals are applied in a receiving well from which the sewage is lifted by centrifugal pumps a height of 18 feet to the tanks. The sewage is turned into the works by a dam in the outlet sewer over which excess of storm-water is discharged without going through the works. On the line to the receiving well is a "sand pit," in which is deposited heavy debris and where floating matter is screened out. A by-pass is in use when the pit is being cleaned. The works will take care of 500,000 gallons a day and cost about $35,000.

It will be noted that a partial chemical purification is the method selected where any purification is necessary and that the attempt thereafter is to secure as great a dilution of the effluent as possible. It is the removal of the remnant of impurity, which is difficult and which is expensive. The efforts of inventors are directed towards this portion of the problem, so far with but little practical success at reasonable cost.

Worcester has so far been unable to secure more than a partial purification, which has been reasonably satisfactory, but which will become less so as the population increases and the dilution of the effluent becomes less. Columbus is in similar situation, except that for most of the year the amount of dilution is greater. No purification is attempted at present, but at least a partial result must be secured at an early day. Some description of the later experiments with the more thorough purification of small amounts of sewage will be given next month.

State License of Surveyors and Engineers. The question of requiring surveyors and perhaps civil engineers to be licensed by a state examining board is being

agitated in the state of Minnesota. The first step to be taken is to make the proper distinction between surveyors and engineers, which will necessitate a separation of the two classes and different treatment of the two cases. This distinction is not made in the minds of most persons and is not made sufficiently clear even in the engineering profession in its lower ranks. There are many self-styled civil engineers whose only basis for a claim to the title is the fact that they have some knowledge of surveying. They are able to sustain the claim in the community because of the fact that the distinction between the two classes is not drawn. A good surveyor may be very far from being a good engineer, and a good engineer is possibly, but not probably, a poor surveyor.

The surveyor is in position to cause much trouble and expense for property-owners if his work is incorrect, just as an "engine-driver," to use the English term, is in position to cause damage to property and even loss of life if he is incompetent to fill the position. Supervision of the surveyor should be on the same plane with that of the stationary engineer, so far as his technical abilities are concerned. Many questions in land surveying are largely matters of judgment, but the best surveyor, where competition is open to all who are technically qualified, and to no others, is the one who will get the most business, just as the best manager of an engine is likely to get the best position.

The civil engineer, on the other hand, is a member of a profession in which technical knowledge and educated judgment go hand in hand, as they do in medicine or the law, and the supervision of his qualifications must be put on higher grounds. Engineers have no state societies with the powers of state medical societies nor state boards of engineers with the powers of certain state boards of health regarding the qualifications of legal practitioners, nor have they the courts or bar associations of the legal profession. The determination of their qualifications should, however, be placed in equally competent hands and made on equally high grounds.

CURRENT INFORMATION.

AMERICAN SOCIETY OF CIVIL ENGINEERS ON METHODS OF CEMENT TESTS.

The most important matter considered at the annual meeting of the American Society of Civil Engineers in New York, Jan. 20-21, was a report prepared by the Board of Direction on the appointment of a committee to consider recommendations concerning methods of making cement tests. Engneerng from time to time concerning the desirability of standard methods rather than standard requirements. The report is as follows:

At a business meeting of the society, held Nov. 4, 1896, it was unanimously voted, in accordance with Articles VI., Section 13, of the Constitution, to recommend to the Board of Direction the consideration of the This report is in line with the editorial articles which have appeared in Municipal appointment of a committee to report on the proper manipulation of tests of cement.

It is quite evident that a committee appointed under this resolution would be concerned only as to the manner and method of making tests and it would not be required to go into a general consideration of cements or cement specifications. It is a generally admitted fact that although a special committee of the society reported to the society in 1885 certain rules and regulations on this subject, nevertheless the development of the cement industry and the more general use of the material, has already caused those rules, although excellent at the time, to be now short of modern requirements. Under these rules it is possible for different experimenters to get widely different results, and such a state of affairs works not only to the detriment and disadvantage of the honest manufacturer, but also to the engineer user of the material. Your board has carefully considered this question and finds the following reasons in favor of appointing such a committee as is proposed by the resolution of the society:

1. That the methods of tests now known to the world as the standard of the American Society of Civil Engineers, while excellent at the time they were adopted by the society, are not the best possible now, and should be brought to conformity with present knowledge and the latest experience of this country and of Europe.

2. That a method of making tests should be so devised and specified in detail as to eliminate as far as practicable the personal element of the tester, in order that the test may more certainly represent the true character of the cement tested. It is a constantly recurring experience with cement manufacturers and users that tests giving unsatisfactory results are, after embarrassing delays and disputes, found to be unfair or incompetent because of some peculiarity in the manipulation. Methods of mixing and making briquettes and conducting the tests which would make these now variable factors uniform in all cases, would save a vast amount of time, trouble and expense. If the end desired can be accomplished and the tests of cements like those of metals be made to represent uniformly and truly the strength of the cement tested, the defects and virtues shown by tests will in every case be due to qualities dependent upon chemical constitution, methods of manufacture or treatment and improvements in these latter would be more easy to discover and make.

The reasons in opposition to the appointment of such a committee appear to be as follows:

1. That it is inadvisable for the society to adopt standards of any kind: that such work is better done when left to individuals.

2. That in the case in question it is doubtful whether it is possible to adopt any methods of preparing and testing briquettes whereby the personal equation can be reduced to a negligible quantity.

Your board, however, is of the firm opinion that the reasons in favor of appointing the committee outweigh those in opposition, especially in view of the fact that a committee of the society has already promulgated rules in this matter, which, for the reputation of the society, should be kept at the highest attainable standard or else revoked.

It seems probable from what has been already said and written concerning the appointment of the proposed committees, that an effort may be made to reopen the entire subject of cement tests as considered by the former committee of the Society, and not confine the work to the simple matter of proper manipulation of tests. Your Board has given some attention to this matter, and is strongly of the opinion that the duties of the proposed committee should not be changed from those outlined in the resolution. Many and continuous efforts are being made in Europe by cement manufacturers and others by concerted as well as individual action, to arrive at some uniform requirements which shall become the standard specifications for cements. But as yet no uniform specification has been decided upon and the problem is probably a more difficult one in this country than it is in Europe. It does not seem at the present time to be advisable to have a rigid set of specifications for cements in this country, where the character of the different products manufactured will necessarily vary with the materials available for use in the different regions, and where the whole process of manufacture is in a course of development which would apparently be rather dwarfed and confined than benefited by a set of specifications put forward by the American Society of Civil Engineers, to apply to the whole country.

As a criticism, it was suggested that the new methods would involve laboratory testing work at about 20 per cent. of the cost of the material, and it was doubtful if insurance of quality would justify this expense. Mr. North said in reply that he knew of an instance where the showing of strength by tests had led a manufacturer to improvements in the quality till a much greater strength was obtained, and the results fully justified the expense. Mr. Whinery also spoke in favor of the report. The vote resulted in unanimously authorizing the appointment of the committee.

ASSESSMENTS FOR PAVEMENTS DECLARED VOID.

An opinion has been filed at Trenton, N. J., by Justice Lippincott of the Supreme Court of New Jersey, setting aside the assessments for paving Broadway and W. Broadway, in Long Branch. He holds that the act of 1892, giving to municipalities governed by commissioners the power to pave streets and make assessments is unconstitutional, because it is special legislation. The case was carried to the court by a writ of certiorari, brought by property-owners assessed.

THE DENVER DECISION REVERSED.

The United States Court of Appeals at St. Louis, Mo., rendered a decision Jan. 18, which reverses Judge Hallett's recent action in issuing an injunction in the case of

Hugh Murphy of Omaha against the Denver Board of Public Works, to restrain the latter from awarding a contract for paving lower Fifteenth and Broadway streets to F. O. Blake & Co., or the Colorado Paving Company. Hugh Murphy was the lowest bidder for the work, but the Board of Public Works did not approve of the kind of material on which he bid and rejected his bid. Mr. Murphy alleged fraud on the part of the board, and Judge Hallett issued a temporary injunction. The Board of Works filed an answer denying the allegations, but on hearing the case Judge Hallett issued a final order for the temporary injunction on the ground that the charter provisions were violated. On appeal to the higher court the city set up the plea that the bidder had no standing in court, and that the lower court had no jurisdiction to review the discretion of the board in determining the kind of materials to be used by the city.

ASPHALT SPECIFICATIONS IN SAN FRANCISCO.

The supervisors of San Francisco are endeavoring to secure the adoption of a change in the specifications which will admit Califronia asphalt upon equal terms of competition with other materials.

EXAMINATIONS OF INSPECTORS OF PAVEMENTS.

The city of New York has regular practical examinations for its inspectors of pavements and recognizes the position of "Engineer of Inspector of Paving." The next examination will take place on Feb. 11. Application blanks can be obtained from Mr. Briscoe, Secretary Civil Service Commission, New Criminal Court Building, New York City.

AN EXPERIMENTAL HIGHWAY TRACK IN PENNSYLVANIA.

Plans for a new roadway to take the place of macadam, as proposed by the Flinn bill, have been prepared and filed with the county commissioners at Washington, Pa., by George M. Ramsey of South Strabane township, who conceived the idea about five years ago, when some of the street railways were built in that section of the country. In explaining his plan recently Mr. Ramsey said:

"The roadbed being properly graded, a stone bed eight feet wide and four inches in depth should be made. The stone, of course, is broken to make a solid foundation for the rails. These rails should be eight inches wide and five-sixteenths of an inch thick. The guide flanges should be high enough to keep the wheels from sliding off. A more simple plan is to plow furrows in the road, proper distances apart, level up the bottom by filling in dirt wherever it is necessary, then lay in the rails and fill around them with broken stones.

"In all cases the rails should be laid straight across water breaks, so the water can run off. The ends of the rails are kept in place by iron plates two feet long, seven and a half inches wide and one-fourth inch thick, driven between the under flanges. No wooden ties are needed. The rails will be kept in place by the pressure of earth about them."

The plan has been tested by Mr. Ramsey, who used wooden rails instead of steel rails. He built a road extending along the public highway running by his farm in South Strabane township, and it has been in use nearly four years without very much repair. The total expense of building the road and keeping it in repair does not equal the annual road taxes which he pays. Municipal Engineering for September, 1894, gives the passage of two bills in the State of Ohio, one permitting Geauga county to borrow $10,000 for the construction of steel tracks, and the other permitting the town of Caulfield to issue bonds for $25,000 to construct a like road to Youngstown. This plan, in Ohio, was urged by Martin Dodge of Cleveland, president of the road commission, with a view to adopting it in lieu of road improvement by macadamizing.

SEWER ASSESSMENTS.

In an address on "Sewer Assessments" at Quincy, Mass., Jan. 12, Herbert Snow, city engineer at Brockton, took up the several methods of assessments provided by law, dwelling upon each at length. He said:

"The method of assessment on 'frontage' alone was unjust for the reason a man who has a corner lot with one house and a frontage of 300 feet at $1 per foot would pay $300, while his neighbor who had a frontage of but 150 feet and four houses on the lot would pay but $150.

"Then there is an undeveloped lot with a frontage of 500 feet and a lot with a frontage of 50 feet upon which there is a large hotel. One would pay $500 and the other who gets a great benefit but for $50.

"The 'area' plan is unjust. Two lots of equal area pay an equal amount, but by locations one of these lots can have but one house while the other may have two or three houses, and still another lot of the same area may have a frontage on three streets and could therefor erect five houses, yet he pays no more assessment than the man who has but one house, though he gets a much larger benefit.

"In some cities the two forms are combined and in this method it is usual to estimate 6-10 of cost on era and 4-10 on frontage.

" 'Entrance fee' is another plan and this can be done by counting the houses in the district, but as an estate cannot be com-

pelled to enter a uniform price for entrance would be unjust.

"Under the 'valuation' plan the law allows only three-fourths of cost to be assessed on the valuation of an estate and if there is no benefit there can be no tax. Two people may own lots of equal valuation, but the sewer may benefit one 10 per cent. and the other but 5 per cent., and therefore this was not a feasible plan.

"The 'general taxation' plan says the public shall pay not less than one-fourth or more than two-thirds the cost. This is on personal as well as real estate. A large block in the center should pay more than a house on the outskirts which may not have a sewer for years, and this should be an argument not to assess too large an amount by tax levy.

"The 'rental system' is an ideal system, for a man pays for the amount of sewer disposal. Sewer rental, if based on water consumption is an ideal system, and in working out this system it will be necessary to know the annual expense and the number of takers. This is, however, impracticable, as it is impossible to know how many would enter and the amount of water each would empty into the sewer without meters.

"Brockton's system is to raise one-half of the whole cost by rentals according to the amount of water consumption taken by meter, one-quarter by a fixed rate on land, and the remaining quarter by taxation. The sewer bonds are payable in annual instalments and the surplus collected is credited to construction account. The speaker, however, thought it better to create a sinking fund by the surplus as now the city council appropriated all they could of it to keep down the tax rate.

"To meet the expense until the rentals are put in, there should be an average cost for twenty years taken and assess the rentals from this average. The annual rental in Brockton was about $8."

HOW THEY ARBITRATE IN COLUMBUS, O.

In a personal letter to Mayor Allen recently Prosecuting Attorney Joseph H. Dyer appealed to him, as the chief executive of the city of Columbus, to instruct the director of law to begin proceedings so that the award of the arbitrators in the West Side sewer case should be brought up for review by the judges of the common pleas court. Accordingly a motion was filed Jan. 14 by Director Bargar to set aside the award. The prosecuting attorney's zeal is explained by his determination to press the prosecution of the contractors on indictments returned against them at the beginning of the trouble. If the award of the arbitrators were allowed to go uncontested it would presumably have an important bearing on this prosecution. It appears, however, that the official representatives of Columbus regard it as their duty to abide by the abitration only in case it is in their favor and to prosecute the contractors even after the arbitrators have decided that they were right and the city wrong.

EXPERT OPINION ON JERSEY CITY WATER CONTRACT.

The specifications for a new water supply for Jersey City, a bid on which from the East Jersey Water Company was accepted December 4, were referred by the Jersey City Board of Trade to George W. Rafter, C. E., for an expert opinion, as well as the question of filtering the present supply. Mr. Rafter has reported that the specifications are so contradictory, indefinite and incomplete as to render rational bidding impossible. The bids submitted, he says, are incomplete and should be rejected. Taking experience abroad as the basis, he thinks there is no reason why the water of the Passaic river could not be efficiently purified by filtration.

THE PARK SYSTEM AND BOULEVARD OF PUGET SOUND UNIVERSITY.

Mr. O. E. Schwagerl, architect and engineer of landscape gardening, connected with the Puget Sound University, Tacoma, Wash., has prepared plans for a boulevard 150 feet in width, between Tacoma and the University park and extending around the suburban lakes. The plans were endorsed by the Chamber of Commerce at a meeting on January 5th. It is the intention to prohibit use of the boulevard for commercial hauling. If the plans are fully carried out the boulevard will be one of the most attractive in the country, owing to the beautiful scenic surroundings. Mr. Schwagerl sends us a few notes, giving the information that the university grounds, which lie along the shore line of Puget Sound, embrace 12,000 acres. There are thirty miles of driveways through the grounds, eighteen for bicycles and seventy for promenades. The gardens and arboratum cover 300 acres, no two ways being planned or planted alike. All curbs and gutters will be replaced by properly formed sod gutters. There will be no grade to exceed 4 per cent. Salt water from the ocean will be provided for sprinkling the ways. "My system of ways," Mr. Schwagerl says, "is new, inasmuch as they not only are located with reference to the best natural topography for grade, but cross-sectionally the wildest way even is adapted to the natural conformation of the ground by the lawn areas or ribbons between each way or walk. The railway is also isolated to permit greater speed, fewer accidents and freedom from dust. The trolley is underground and no poles will be allowed."

PROPOSED AMENDMENTS OF LAWS RELATING TO IMPROVEMENT BONDS.

Considerable attention has been directed toward the adoption of some method for the protection of Barrett law bonds in Indianapolis and some important and commendable changes have finally been decided upon, which will be proposed in a bill introduced in the legislature. It has been the duty of the treasurer heretofore to receive all money tendered on such assessments, but his duty ended here. If the assessments were not paid when due the matter rested with the holder of the bonds, who has a right to foreclose to get his money. It has been observed that in a majority of cases the property-owner is delinquent because of a lack of information in regard to improvements, and on account of the fact that these payments have not heretofore been registered on the regular tax duplicates. The provisions of the new bill will make it the duty of the county treasurer to make all collections on Barrett law assessments and will prohibit the contractor from suing on them. An index of the Barrett law books will be placed on the regular tax duplicates, and when a man comes in to pay his taxes his attention will be called to the Barrett law payments; if they are not paid before the last day for payment of taxes he will be charged 10 per cent. penalty, and a notice of his delinquency will be sent him by mail; he will then have until June 1 to make the payment, and if not made them, an additional 10 per cent. penalty will be charged; the matter will then be allowed to rest until the fall payment of taxes, the delinquent being charged 20 per cent. for his failure to pay. The bondholder will, in the meantime, have received his money from the county, the funds that are held by the city as a guarantee for the repairs of streets being made to make the payments for delinquents; if the November installment is not paid when due there will be a penalty of 10 per cent. added to it, and another 10 per cent. if it is not paid before Jan. 1; after Jan. 1 all assessments that are not paid will be certified to the county auditor with the other regular delinquencies, and sales will be made in the manner prescribed for such sales. When a man accepts the provisions of the Barrett law he must sign an agreement to waive all rights he may have to object to the regularity of the proceedings by which the work was done, and must accept the improvement; he waives all right to defend against a suit to collect, and foreclosures always result in ordering a sale of the property or a settlement of the claim. Those who do not accept the Barrett law still have the right to set up any of a large number of defenses to a suit to collect an assessment, and for this reason a sale cannot be made except through regular foreclosure proceedings. The bill will provide for this class of persons, that the treasurer shall give notice by mail immediately after a property-owner becomes delinquent; then on the first Monday of each month he shall print a list of all delinquents in a daily paper, giving the improvement for which that assessment is made and the amount due; in ten days after this advertisement appears the contractor will have the right to bring suit to foreclose. Under the new bill the property-owner will receive two written notices and one through advertisement before foreclosure proceedings can be begun, while at present the only notice he gets is one from the contractor, when the assessment roll is approved, notifying him that he owes a certain amount and that it must be paid within thirty days.

INTEREST ON DEFERRED PAYMENTS FOR IMPROVEMENTS.

A decision has been filed by Judge Kelly, in the Ramsey county district court, in the case of George W. Reese against the city of St. Paul, Minn. The plaintiff held a contract to repair the wooden sidewalks in the city during 1895. Interest was claimed from the date of the fulfillment of the contract to the date of the commencement of the suit, which precipitated a controversy over the question whether or not a contractor, under such circumstances, is entitled to interest on unpaid balances.

Judge Kelly holds that a reasonable time after the completion of the contract must be given the city to levy and collect the assessment for the work done, as the assessment cannot be made until the work is completed and accepted by the city. The contract was completed Nov. 15, 1895, and the judge holds that four and a half months is a reasonable time for levying and collecting the assessment. He allows judgment for the unpaid balance on the contract, which was not disputed, and interest from April 1, 1896, to Sept. 9, 1896, the date the suit was begun.

NEED OF UNIFORM IMPROVEMENT-LAWS IN IOWA.

Legislation affecting municipal corporations is desired by Iowa cities, as the present laws are much complicated. The propriety of calling a convention of municipal

officers to agree upon uniform laws relating to this subject is being discussed, when it will probably be presented to the legislature for action. The laws of towns and cities relating to paving, sewerage and special assessments in general have been adopted to suit different cities. Under the supreme court decision they are regarded as in the nature of general legislation, yet each act, in fact, relates to only one or two cities, with the result that there is endless confusion. Paving assessments are not uniform and it is very difficult to have the work so that it will undergo the test of the courts, as city attorneys are often unable to ascertain which laws apply to the different cities.

TOWN GOVERNMENT IN NEW JERSEY.

Representatives of twenty-four boroughs met at Trenton, N. J., Jan. 18, to receive the report of the special legislative committee appointed to devise some scheme to improve the existing borough laws. A draft of a bill was submitted to the representatives, but was referred back to the committee with power to put it in shape and present it to the legislature. The bill provides that borough clerks be appointed by Common Council and not elected, and that their terms shall be in the discretion of council; that a treasurer may be appointed in addition to a collector; that the borough election shall be held on the same day as the township election in which the borough is located; that the borough solicitor and assessor need not give bonds; that councilmen shall be elected for three-year terms and they must live in the ward they represent; a quorum of councilmen to consist of four members or three members and the Mayor. The bill provides for the election of a Mayor and six members of council, a freeholder, assessor, collector, three commissioners of appeal, pound-keeper, overseer of the poor. The appointive officers are marshal, clerk, commissioner of highways, three commissioners of assessment, who shall also be sinking fund commissioners, solicitor, police justice, and as many police officers as council may provide for by ordinance. The Mayor and council may appoint a borough engineer if they see fit. The salary of the Mayor is not to exceed $300, and the term shall be two years; council shall receive no salary and the members shall be elected for three years. The term of office of borough clerk shall be optional with council; freeholder, three years; assessor, three years; collector, three years; commissioners of appeal, one year; pound-keeper, one year; overseer of the poor, one year; borough counsel, at will of council; commisisoners of highway, one year; commissioners of assessment, three years; police judge, one year; police at will of council. The salaries are to be fixed by council.

MUNICIPAL JURISDICTION OVER STREETS IN CALIFORNIA.

The Supreme Court of California has rendered an opinion to the effect that streets must be dedicated to public use and accepted by the municipality before the city acquires jurisdiction to order street improvements. The case in which the decision was rendered was brought about by N. W. Spaulding, who received a contract from the Board of Supervisors of San Francisco to grade a street, commencing action against property-owners to foreclose his assessment lien. The lower court gave the plaintiff judgment, but the Supreme Court reversed this decision.

DECISIONS AFFECTING IMPROVEMENT ASSESSMENTS IN PITTSBURG.

The Supreme Court of Philadelphia, Pa., handed down two decisions, Jan. 4, which were of much importance to Pittsburg. One decision was in the Amberson avenue paving case, which was decided against the property holders of Pittsburg, who made the appeal. The contention began in 1892, since which time there has been considerable litigation over the matter, resulting finally in its being carried to the supreme court. Amberson avenue, which is one of the finest residence streets in the east end, was paved in 1891, and in 1892 the property holders began to take exception to certain matters connected with the paving of the street, particularly regarding the paving of the sidewalk, for which they had not asked, claiming that it was illegally put down. In the Beechwood avenue sewer case, Justice Dean's decision in the matter of watershed assessments was against the city. The decision was not unexpected, and it will result in a loss to the city of perhaps $500,000 in watershed assessments, liens for which have been filed, but, by virtue of the ruling, are made uncollectable, thereby relieving the defendants of such liens from the payment thereof. All assessments for sewers can, in the future, only be made on abutting property instead of on that forming a portion of the watershed drained by the sewer and realizing equal benefits with abutting property. It has been suggested

that the city can file liens against all property that has not paid sewer assessments, and while it cannot collect the money, the lien will stand and the owner, wanting to sell, will not be able to give a clear title except by going into court and having the lien stricken off, and that rather than to take this action, many will pay. This decision is in line with one rendered about a year ago by the Supreme Court, in the case of the city of Williamsport, which was that no assessments for the construction of a sewer could be made off the line of the sewer and that consequently all assessments, made on property which was compelled to drain into the sewer, but which did not abut upon the sewer, were illegal.

A PENNSYLVANIA SCHOOL BOARD'S LIABILITY FOR PAVING.

In the case of the Barber Asphalt Company vs. the Erie School District, Erie, Pa., the school board contends that it did not sign the petition for the asphalt pavement around the Central School building. The signature of a member of the board was attached after a resolution was passed favoring the pavement, and, as under a recent decision churches and schools must pay sewer and paving assessments, much interest is attached to the suit.

WIDE TIRE ORDINANCE AT PROVIDENCE.

A wide tire ordinance has been passed by the city council, at Providence, R. I., as follows :

Section 1—It shall be unlawful for any person or persons to transport, haul or convey, or cause the same to be done, any load, weight or burden over or through any of the public parks, squares or grounds of the City of Providence, or any wagon or other wheeled behicle having a tire less than the following widths for the following loads in ton weights of 2,000 pounds, the weight of the vehicle included: On four-wheeled vehicles, for any load or burden exceeding one and one-half tons' weight, and not exceeding two tons' weight (the weight of the wagon or other four-wheeled vehicle included), not less than two inches in width. For any load or burden exceeding three tons' weight (the weight of the vehicle or other four-wheeled vehicle included), not less than three inches. For any load or burden exceeding three tons' weight (the weight of the wagon or other four-wheeled vehicle included), not less than four inches. For any load or burden exceeding five tons' weight, and not exceeding six tons' weight (the weight of the wagon or other four-wheeled vehicle included), not less than six and one-fourth inches. For any load or burden exceeding six tons' weight (the weight of the wagon or other four-wheeled vehicle included), not less than eight inches.

On all two-wheeled vehicles used for like purposes, the widths of tires shall be as follows :

For any load or burden exceeding one ton weight, and not exceeding two tons' weight (weight of the vehicle included), not less than three inches.

For any load or burden of two tons' weight and over (weight of vehicle included), not less than four inches, provided that nothing in this ordinance contained shall be construed as applying to the apparatus owned or controlled by the Providence fire department.

Sec. 2—Every person violating any of the provisions of this ordinance shall be fined not exceeding twenty dollars, or imprisoned not exceeding ten days for each and every offense.

INVESTIGATION OF PAVING AT DETROIT.

A special investigating committee was appointed Jan. 5 at Detroit, Mich., at the suggestion of Mayor Pingree, to investigate the work on the new pavement on Jefferson avenue, between Crane avenue and the city limits, of which the residents complained before it was completed, claiming that the concrete was not of the required thickness. In company with Alderman Coots and Engineers McCormick and Jerome, Mayor Pingree investigated the charges Jan. 4 by systematically digging up the pavement in selected localities and measuring the depth of the concrete. The full length of the pavement was examined at reasonable distances apart, and twelve tests were made. The specifications called for six inches of concrete, but the result of the tests showed that the concrete ranged from 3¼ to 5¾ inches in tickness. The committee apointed Jan. 5 consisted of Aldermen Coots, Patterson, Ashley, Beamer and Scullen. The work was done by the Talbot Paving company, the contract price being $18,223.11.

TECHNICAL AND TRADE MEETINGS.

INDIANA ENGINEERING SOCIETY—The Seventeenth annual meeting of the Indiana Engineering society was held in Indianapolis Jan. 7, 8 and 9. A bill has been prepared by J. F O'Brien to be presented to the legislature in relation to the construction of gravel roads. An informal talk on the subject of city engineering was given during the meeting by William M. Whitten, City Engineer at South Bend, Ind., and the uses of Portland cement was a subject for general discussion. "Brick Streets" was the subject of a paper by A. W. Smith, City Engineer, of Kokomo, an abstract of which appears elsewhere in this number of Municipal Engineering. The officers elected for the ensuing year were:

President, A. W. Smith, Kokomo; vice-president, James A. Mitchell, Noblesville; secretary, James B. Nelson, Indianapolis.

ILLINOIS CLAYWORKERS' ASSOCIATION—The officers elected for the ensuing year by the Illinois Clayworkers' Association are as follows: President, W. S. Purington, Galesburg, Ill.; vice-president, A. L. Salisbury, Aurora; secretary, G. C. Stoll, Grant Park; treasurer, H. F. Townsend, Avon. The Chicago members of the association have asked that the next annual meeting be held in Chicago and the invitation was referred to the executive committee.

NORTHWESTERN ELECTRICAL ASSOCIATION—At a recent annual meeting of the Northwestern Electrical Association, held in Milwaukee, Wis., the special committee consisting of H. L. Dogherty of Madison and Elihu Coleman of Fon du Lac, appointed to investigate the subject of municipal ownership of lighting plants, decided that municipal ownership is impracticable. A resolution accompanied the report, which, it was stated, was not intended as a boycotting move, and which was adopted, proposing:

"1. That the legislature should grant no powers to municipalities to erect and maintain lighting plants for general use unless, where franchises have been given the owners of the same, they shall have been remunerated as herein set forth.

"2. That honorable manufacturers will not sell to municipalities until these conditions have been observed, and central station men cannot afford to deal with manufacturers showing themselves thus dishonorable.

"3. If we cannot show to municipalities that the business is unprofitable to a city, including, of course, the items of taxes, lost interest on the investment, etc., then we should submit."

ILLINOIS ENGINEERS AND SURVEYORS—The twelfth annual meeting of the Illinois Society of Engineers and Surveyors was held in Springfield, Jan. 27, 28 and 29. The programme for the meeting embraced the following papers: "Our Special Assessment Laws," W. S. Shields; "The Streams of Illinois and Their Future Development," Eben J. Ward; "Brick and Macadam Combined in Hard Road Construction," J. Ed. Miller; "The Coming Adoption of the International System of Weights and Measures—House Bill 7,251, Fifty-Fourth Congress," S. S. Greeley; "Best Location for Tile Drains for Public Highways," "Rapid Computation," M. S. Ketchum; "A Concrete Arch," Charles H. Nicolet; "Test of a High Duty Pumping Plant Under Ordinary Working Conditions," Dabney H. Maury, jr. There were discussions also on the following topics: "What Causes Waves in Brick Pavements on Concrete Foundations?" "Need of Increased Knowledge on Part of Citizens Concerning the Work of the Engineer;" "Gasoline Engines and Their Application to Road Machines;" "The Office of County Surveyor;" "The Status of the Land Surveyor in Illinois;" "Riparian Ownership of Accretions;" "Perpetuation of Section and Quarter Section Corners, and Public Records of Same;" "Subsidence Process in Sewage Disposal," A. N. Talbot; "Final Disposal of Sewage of Communities Having No Large Water Courses;" "Utility of Intercepting and Overflow Sewers."

MINNESOTA SURVEYORS AND ENGINEERS—The second annual meeting of the Minnesota Surveyors and Engineers' Society was held in St. Paul Jan. 13, 14 and 15. Papers were presented as follows: "Location of Public Highways," D. F. Akin; "Highway Bridges and Their Construction," S. H. Hedges; "Some Desirable Legislation from the Standpoint of the County Surveyor," Lycurgus R. Moyer;" Some Important Points Relating to the Design of Modern Steam Plants in Power Stations of Municipal Water Works, Electric Light and Power Plants in Country Towns and Villages," Arthur Gibson; "Office Records," C. L. Annan; "Reservoir System for Improving Navigable Rivers," Archibald Johnson; "An Engineer Abroad," Prof. William R. Hoag; "Bicycle Paths and Their Construction," George L. Wilson; "A Few Thoughts on the Road Question," N. Y. Taylor; "Country Road Improvement," Fred Chamberlain; "General Points on Land Surveying," J. H. Armstrong; "The Landscape Engineer," Frank H. Nutter; "Railway Bridges," Max Toltz; "Some Ideas from the British Ordinance Survey," John Abercrombie; "A County Surveyor's Records," O. J. Anderson.

IOWA ENGINEERING SOCIETY.—The annual meeting of the Iowa Engineering Society was held in Ottumwa, Ia., beginning Jan. 20. Papers were presented as follows: "Permanent Improvement of Streets in Small Cities," C. R. Allen; "Works of Standard Oil Company at Whiting, Ind.," L. H. Stone; "County Surveyor's Records," Paul Ilg; "The Disposal of Garbage," Prof. A. V. Simms; "The Ottumwa Filters," J. W. Newell; "Present Magnetic Declination and Rate of Annual Change at Glenwood," Seth Dean.

NATIONAL BRICK MANUFACTURERS—The eleventh annual meeting of the National Brick Manufacturers' Association

will be held at Buffalo, N. Y., beginning Feb. 2, in the main hall of the Builders' Exchange. The usual arrangement for special railroad rates has been made, whereby persons attending the meeting will buy tickets going to Buffalo at the regular price, taking from the local agent a certificate, which will entitle them to a rate of one-third full fare for the return trip. If a certificate cannot be issued by the local agent a receipt from him will suffice. Among the papers which will be read at the meeting are the following: "Brick Yard Ethics," T. P. Plumridge, St. Louis; "Some of the Essentials to Success in Making and Marketing Paving Brick," George F. Cotton, Table Rock, Neb.; "Burning Brick," H. L. Boas, Reading, Pa.; "Brick Yard Management," Frank Alsep, Chicago; "The Clay Resources of New York," Prof. Heinrich Reis, New York City; "Difficult Problems in Brick Making," George C. Hicks, Boston; "Using Heat From Cooling Kilns for Drying Purposes," Robert Lyle, Perth Amboy, N. J.; "Success of Brick Business As Affected by Geographical Conditions and Lack of Mutual Understandings," H. H. Fernald, Boston.

Among the special topics for special discussion are the following: "Is a Vitrified Brick Suitable for Building Purposes?" "Which is the Proper Way to Take a Fair Sample of Clay for Analysis or Test?" "Where Can Paving Brick Be Sorted to the Best Advantage—In the Kiln or on the Yard?" There will be various other practical questions proposed for discussion.

A visit to Niagara Falls will be a feature of the meeting. The sessions will probably continue until the 5th.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—At the annual meeting of the American Society of Civil Engineers officers for the next year were elected as follows: President, Benjamin Morgan Harrod, New Orleans; Vice-President, Geo. Henry Hendell, San Francisco, and John F. Wallace, Chicago; Treasurer, John Thomson, New York City; Directors, Rudolph Hering, New York City; James Owen, Newark, N. J.; Henry Grant Morse, Wilmington, Del.; Benjamin Lincoln Crosby, St. Louis; Henry Stevens Haines, Atlanta, and Lorenzo M. Johnson, Eagle Pass, Tex. The net increase of membership during the year was ninety-six. The losses by death numbered thirty. The total receipts for the year amounted to $68,125.69, and expenditures, $56,669.81, leaving a balance of $11,455.88. Of the expenditures, $28,973.87 was on the new Society house.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL—The Civil Engineers' Society of St. Paul elected officers at their January meeting as follows: President, K. E. Hilgard; Vice-president, Oliver Crosby; Treasurer, A. O. Powell; Secretary, C. L. Annan; Representative on the Board of Managers of the Association of Engineering Societies, E. E. Woodman. Mr. L. W. Rundlett read a paper on "The Centerville Extension of the St. Paul Water Works," exhibiting maps, drawings, specimens of material, etc. The detail conduit construction, the location of mains, artesian wells and pumping stations and statements of quantities, cost, etc., were given.

PERSONAL.

Edward Freel, sewer and water works contractor, died Dec. 24 at Brooklyn, N. Y., aged sixty-eight years.

Frank P. Cobb has been made City Engineer and Morris Kennedy Superintendent of Streets at Chicopee, Mass.

M. P. Snyder has been elected Mayor at Los Angeles, Cal., to succeed Mayor Rader.

Carleton Greene of the Barber Asphalt Paving Company, Buffalo, N. Y., has gone to the island of Trinidad to take charge of the Trinidad Asphalt Company's works for a year.

R. B. C. Bement was re-elected President of the Board of Water Commissioners, J. F. Hoyt, Vice-President, John Caulfield, Secretary, and A. R. Starket, Superintendent at St. Paul, Minn., Jan. 9. William R. Johnson and John H. Woltersdorff were appointed new members of the board.

T. L. Stillwell has been elected Mayor at Crawfordsville, Ind., to fill out the unexpired term of Fred Bandel, deceased. Mr. Stillwell has served as Mayor of the city before.

H. H. Havill has been appointed Engineer of the Sewage Purification Works at Brooklyn, N. Y.

Warren R. Keith has been appointed Superintendent of Streets by the City Council at Brockton, Mass.

Campbell Leckie has been appointed Engineer in charge of the Sewage Interception Works at Hamilton, Ont.

A. T. Byrnes of Brooklyn, N. Y., has been appointed Assistant Engineer under State Engineer and Surveyor Adams at Albany, N. Y.

W. G. Nixford has been appointed Sewer Commissioner at Oneida, N. Y., to succeed C. Herman Phillip, who resigned.

George A. Johnson has been appointed City Engineer at Derby, Conn., to succeed D. S. Brinsmade.

Alfred Quick has been appointed Engineer in charge of the construction of the water works improvements and extensions at Baltimore, Md.

Prof. Leonard Metcalf has resigned his position as Professor of Civil Engineering at the Massachusetts State Agricultural College, Amherst, Mass., to become associated with William Wheeler, hydraulic engineer, Boston, Mass.

Isaac W. Smith, M. Am. Soc. C. E., Chief Engineer of the Water Commission, Portland, Ore., and Superintendent of the City Water Works, died Jan. 1, aged seventy years.

Prof. W. W. Folwell was re-elected President of the board of Park Commissioners Jan. 16, St. Paul, Minn., at the annual meeting of the board. Abram S. Adams was elected Vice-President; C. J. Rockwood, Attorney; William Berry, Superintendent, and J. A. Rideway, Secretary.

C. H. Taylor of Kokomo, Ind., succeeds L. C. Burns as Superintendent of the St. Joseph Water Company, St. Joseph, Mo.

John W. Wade succeeds S. A. Bickel as County Surveyor of Lewis and Clarke county, at Helena, Mont.

Herbert Snow, City Engineer at Brockton, Mass., addressed the citizens of Quincy, Mass., Jan. 12, on "Sewer Assessments."

Superintendent Garey and Secretary Mendenhall of the Board of Park Commissioners, Los Angeles, Cal., have been re-elected.

Joseph Miller has been elected Water Commissioner at Yonkers, N. Y.

F. L. Northrop has resigned his position as Superintendent of the Milford Water Company, Milford, Mass.

Isaac M. Story, C. E., has been elected a member of the council at Somerville, Mass.

Mayor Farnsworth has been made ex-officio President of the Park Commission, at New Haven, Conn. The other members of the board are: Vice-President, Judge S. E. Baldwin; Secretary and Treasurer, Henry F. English; Assistant Treasurer, William W. Farnam; Assistant Secretary, James E. English.

Mayor Sutro of San Francisco appointed a Street and Sewer Inspector when he went into office last year, and his successor, Mayor Phelan, has followed his example. Mr. Phelan has also appointed Ernest McCullough, the Consulting Engineer for the Merchants' Association, as his Consulting Engineer.

Frederick W. Patterson, City Engineer at McKeesport, Pa., has been elected County Engineer, and will have in charge the construction of the new roads.

H. B. Abercrombie, City Engineer at Westport, Mo., has been elected Water Commissioner, to design and construct the water works system.

Frederick H. Lewis, M Am. Soc. C. E., of Booth, Garrett & Blair, Philadelphia, Pa., has sailed for Europe, where he will spend two months in the study of European practices of using, testing and manufacturing cements.

MUNICIPAL REPORTS.

PITTSBURG, Pa.—The Pittsburg department of public works includes the board of public works office, the bureaus of engineering and surveys, highways and sewers, city property, water supply and distribution, assessment of water rents, public light, the public parks and the board of viewers. The typographical form of the report seems to be left to the printer, so that a large book is made when a little supervision by an expert would materially reduce the size of the book and at the same time put much information, now widely spread, into a more convenient form. This criticism does not apply to the inset sheets in the report of the bureau of engineering and surveys, which give detailed information of the amounts and prices of items in improvements as clearly and concisely as could be desired. One column in the table of sewers gives the kind of material found in the trench and contains a new term "callous" for a material which seems to occur with clay. The statistical tables in the report of the superintendent of the water works are also in excellent shape and give full information of the details of work and cost of same, in pumping, repairs, maintenance and new construction. About 145,000 feet of new pipe have been laid at average costs per foot as follows, all items included: 4-inch pipe, 50 cents; 6-inch pipe, 68 cents; 8-inch pipe, 91 cents; 12-inch pipe, $1.42; 20-inch pipe, $2.96; 30-inch

pipe, $5.61. Nearly all pipe is class B, a small amount being class C. The reports give the expenditures of the various departments and some small items of receipts, but the financial condition of the water works system and its receipts must be obtained from other reports. From the tables of cost of pumping the information may be derived that the average cost of pumping 1,000,000 gallons one foot high is about 2¼ cents, varying from 2.14 cents for the larger station to 33 cents for the small pumping station. These figures must be a little too large, as the correct system of taking averages has not been followed.

TROY, N. Y.—The forty-fifth annual report of the water commissioners of Troy, N. Y., is noteworthy for the fullness in details and the clear manner in which the information is grouped. The summaries for every year since 1855 are also given so that comparisons and averages are easily obtained. Full statements of character and manner of payment of debt are given, of sizes, lengths and location of pipe in detail and summaries, rates, receipts and expenditures. The superintendent's report gives in detail the construction completed, full details of engine records and of all expenses, with totals for all years since 1891, so that almost any desired detail of cost or total of work can be obtained. The full summary of statistics according to the plan of the New England Water Works Association is also given. The receipts for the year were $96,066.98 and the expenditures, not including the payments to the sinking fund and $15,139,.62 for new construction, were $75,987.05. No appropriation for the works is made by the city. The payments to the sinking fund were $18,787.50, so that part of the new construction was paid for from current receipts. The remainder was raised by sale of bonds. The city is increasing its service, as the limit of the present service will soon be reached. Since the year 1855, when the present method of management was adopted, the works have paid the entire cost of the plant, amounting to about $1,268,278.70 to date, and all expenses of maintenance and interest and sinking fund, accumulated a bonded indebtedness of nearly $500,000, which is now reduced to $303,500. This method of making the water users pay all the expenses of the water system works less injustice in Troy than in many other places, for of the population of 65,000, it is estimated that 60,000 are on the lines of pipe and 58,000 are actual consumers.

WILLIAMSPORT, Pa.—The annual report of the city engineer, George W. Snyder, has been submitted to councils. While the city has made commendable progress in paving and repaving during the last few years, and now has 100,781 square yards of modern pavement, yet it has not increased its paved area in proportion to its gain in population and wealth. With the exception of West Third street the city has very little more paved streets than it had twenty years ago. Some of the streets paved then are now maintained as dirt streets. Of 76.6 miles of streets and alleys in the city only 5.8 miles are paved, but they are being rapidly repaved and in about three years the city will have finished the work. The city's work will then stop and no new pavements can be built unless the cost thereof is assessed on the property-owners abutting on the line of the improvement. The condition of the city in regard to house sewerage is most gratifying and it is not likely that any appropriation for house sewers will be necessary during the next year, as sufficient funds will likely accrue to the sewer fund to construct any sewers that may be required. City Engineer Snyder recommends the construction of a number of sewers in order to complete the system before the streets are paved. Unlike the house sewer system, only the smaller and less important of the storm sewers have been built, leaving the larger and more extensive mains to be provided for. Attention is called to the need of a permanent inspector to inspect the city sewers and see that sewer taps and house connections are properly made and street excavations properly refilled. Street cleaning has been done under contract since May 1. From May 1 to Jan. 1, 5,063,458 square yards of surface were cleaned at a cost of $1,772.21, of which 5 per cent. has been retained. The contract rate is 35 cents per 1,000 square yards for one cleaning. Streets have been cleaned on an average of twice a week. The contract system is giving better results and is much cheaper than when the work was done by the city's force. There is still, however, room for improvement. The streets are fairly clean after each sweeping but are not cleaned often enough to be continually so. Better satisfaction would likely be given if the more important streets were gone over once a day by hand and in addition swept once or twice a week by machine.

CHICAGO, Ill.—The report of R. J. McDonald, superintendent of the street de-

partment, shows that the following work was done during the last year:

	Sq. yds.	Miles.	Cost.
Asphalt	303,313.16	16.91	$ 678,817
Brick	96,975.30	4.38	163,344
Cedar	768,198.25	43.50	879,017
Granite	74,953.62	3.55	133,315
Macadam	262,752.42	13.52	260,028
Oak blocks	383.00	.02	478
Curb and fill		.15	1,561
Stone curb		.22	1,648
Curb wall		.10	900
Total	1,536,575.75	82.35	$2,119,111

The amount of repaving done by the division foreman in repairing improved streets and replacing pavements where openings were made on account of street permits were 202,226 square yards.

During the year 150.84 miles of plank sidewalks, 82.75 miles of concrete walk, and 3.03 miles of stone walk were constructed, making a total of 236.60 miles.

A total of 971 miles of unimproved streets were ditched and graded by the department, and $75,696.33 expended for material on improved streets.

G. L. Clausen, superintendent of the bureau of sewers, gives an approximate amount of new sewers constructed, the cost of same, and the cost and maintenance of sewerage system during the year 1896, as follows:

	Cost.
57 miles main sewers constructed, 1 ft. to 9 ft. in diameter, including 2,177 catch basins built	$719,279.89
34 miles house drains constructed	26,454.13
Cleaning sewers and catch basins	94,376.92
Raising manholes and catch basins to grade on streets being improved	44,652.33
Repairs of sewers and catch basins	32,692.48
Maintenance of pumping stations	38,683.72
Appropriated salaries	24,465.59
Total	$980,605.06

The report of Commissioner of Public Works Downey shows the work of his department.

The report of the bureau of street and alley cleaning shows that the total appropriation for the year was $561,000. The total cost of street cleaning was $265,636; removing dead animals cost $37,500; pay of ward inspectors amounted to $33,972; office salaries were $9,499; the cost of removing garbage was $312,573; cash collected from dumps amounted to $6,263; from street permits, $14,656. The bureau shows that the difference between $672,420, appropriated to defray expenses for the year, and $662,181 expended, is $10,238, credited to the snow account.

During the year 2,448 58-100 lineal miles of streets were cleaned at an expense of $8.40 a mile; 10,837 23-100 lineal miles at $12.50 a mile; 2,360 83-100 lineal miles at $2.50 (work done in daytime in First district); 209 35-100 lineal miles of alleys at $6.80 a mile (First district); 312 73-100 lineal miles of bridges, viaducts, and approaches at $6.80 a lineal mile, making a total of $165,276.

Since Nov. 12, 1896, 1,107 lineal miles of streets were cleaned by hand, cost of which amounted to $12,047, or an average of $10.88 a mile.

The unimproved alleys were cleaned during the year at a cost of $10,051.

During the year 16,769 dead animals were removed from the city. Of this number 5,753 were horses, 264 cows, 10,002 dogs and 730 cats.

DES MOINES, Ia.—The report of the board of public works shows the work and improvements accomplished during 1896 to have been as follows:

Cleaning catch basins	$ 2,012 55
Lights, street and public buildings	35,512.82
Road districts	4,339.84
Poll tax	13,263.00
Grading contracts	12,156.53
Miscellaneous improvements	4,805.37
Pay rolls, gradings, etc	38,185.32
New sidewalks	4,852.71
Miscellaneous bills	16,537.10
Sewers, 8,270 feet	17,99.200
Cement curb, 21,053.03 feet	7,282.17
Brick pavement, 71,395.08 yards	97,268.39
Total	$254,807.80

MEMPHIS, Tenn.—The annual report of A. T. Bell, City Engineer, shows that during the last year this city has expended $145,971.21 for street paving and stone curbing, as follows: Brick, 10972 ft., $81,600; granite, 1,669 ft., $6,000; limestone block, 3,044 ft., $4,420; gravel and stone gutters, 10,812 ft., $13,910; Novaculite pavement, 2,877 ft., $7,529; stone curbing, 76,483.81 ft., $32,612.21. The engineering force has been so worried and harrassed with repairing wooden curbing that Mr. Bell feels great pride in having succeeded in replacing about sixteen miles of it with stone curbing.

MINNEAPOLIS, Minn.—The report of Sewer Engineer Ilstrup shows that more than five miles of sewers were laid during the last year, and that the expenditures of the department for the year amounted to $122,536.12, of which $89,489.47 was spent in the construction of new sewers. Of the remainder of this sum the largest item was $20,119 for repairs and other work on old sewers. The sum is larger than usual on account of the large amount of paving work, which necessitated the rebuilding to a greater or less extent of the manholes, catch basins, etc. A matter of pride in the department is the comparison between the estimates of cost and the actual cost of

the sewers. It was estimated last spring that the total cost of the work would be $89,211, and this sum was exceeded by only $278, which is considered as close to absolute accuracy as could be possible in view of the character of some of the work, such as tunneling 100 feet beneath the surface and under railway tracks.

BINGHAMTON, N. Y.—The report of the board of water commissioners shows that the receipts for the year, from all sources, have been $90,908.04, which, if the minimum amount of water furnished the city without charge were added, would amount to at least $152,000. The expenditures have been $86,030.26, but this includes about $20,000 which was paid for pipe and materials for use during the coming year which the board was induced to purchase on account of the low price offered. The water has been analyzed by the state board of health and pronounced of good quality. Examinations have been made of several points with a view to a supply of water, but as yet have proved unsuccessful. A plan is being investigated now whereby the board hopes to avoid the necessity of pumping roily water into the mains. In order to get the required stream pressure it will be necessary to replace the two small boilers with new ones of greater strength and capacity. The indebtedness of the board is $13,000 in bonds drawing 7 per cent., and $153,000 in bonds drawing 3½ per cent., amounting to $166,000, and interests and bonds amounting to $7,765 will be paid from the earnings.

WORCESTER, Mass.—A marked increase in the amount of road building and road mending accomplished by the street department is shown in the annual report of that department. The effect of agitation for permanent work, and the uselessness of constant repairs on temporary work is beginning to be recognized, and the first steps toward asphalt and brick street paving have been taken. The greatest improvement in street construction has come from laying block pavement on a foundation of concrete. Formerly the block were laid on an earth bottom with the result that irregularities appeared very quickly upon the surface. A great number of asphalt sidewalks have been laid and new brick walks constructed during the year. The law passed in June, 1895, which provided that when the cost of a sidewalk had once been paid by abutters the city should maintain it forever has had the result of causing a great deal of labor to fall on the street department. The number of cross walks laid has increased, and the practice of laying them in a cement bed has been continued. The intention of the department was to pave four streets with asphaltina and two were paved, but the third street was scarcely half finished when the asphaltina plant in Boston was burned down and the branch work in Syracuse was unable to supply the necessary material. Owing to numerous complaints of the neighboring inhabitants the Boston authorities refused to allow the reconstruction of the plant in that city, thus ending matters as far as one and one-half of the four original streets are concerned until next year, when it is hoped the work of completing them can be early undertaken. In July of 1896 the legislature made its first appropriation for pieces of state road to be awarded to different towns and cities in Masaschusetts, and this city was presented with $7,000 to be devoted to the extension of the Paxton State road in the direction of Tatnuck. The lateness of the appropriation, however, and the simultaneous beginning of so many pieces of state road, resulted in a scarcity of superintending engineers. The street department was so crowded with work that it sub-let the contract for the work to E. Baxter Johnson and Fred A. King, who were to conduct it under the supervision of a state engineer. By means of this arrangement it was found that the city can get the work done cheaper than under the public road system, while the presence of the official engineer insures the exclusion of bad work. The sewer department finds a perplexing problem in the separation of the entire sewage of the city, from the surface water, which will involve the reconstruction of the entire system of sewers at an estimated cost of about $900,000. A greater amount of the sewage of the city is treated at the sewage purification works at Quinsigamond than ever before. The men at the head of the engineering and sewer departments have given much attntion and study to the disposal of sludge, which has been a perplexing feature of the work at Quinsigamond, and a satisfactory solution of the problem seems near at hand. Experiments have been prosecuted at the works for some time and the results obtained mean a saving to the city of thousands of dollars. Instead of purchasing a filter press for sludge, as could have been done under the order of the city council, Superintendent of Sewers Eddy and City Engineer McClure concluded to hire one at a time before making a purchase outright. The result of their experiments shows that slight modifications

of the standard filter presses will save thousands of dollars for the city annually in the matter of pressing sludge.

The increase of the city's water supply has been given attention by the water and engineering department, whose force has been busy all year in working upon the Kettle brook system, the construction of a new dam at Kent's pond, in the cleaning of the brook, and the construction of a new spillway at Paxton reservoir, and old pipe lines have been reconstructed and new ones extended.

NEWARK, N. J.—Mr. Ernest Adam, engineer of the Board of Street and Water Commissioners of Newark, N. J., furnishes us a copy of his report, showing the extent of public improvements made in Newark during 1895, as follows:

STREET PAVING.

	Miles.	Sd. yd.	
Asphalt	7.05	144,983	$404,117 96
Brick	1.36	30,907	74,154 38
Granite (conc. base)	1.17	18,200	47,632 00
Granite (sand found.)	3.06	67,225	147,374 30
Telford	0.88	8,279	5,041 20
Totals	13.52	269,599	$678,679 84

The cost of inspection is not included. Average price per square yard for which the contract was awarded: Asphalt, 6-inch concrete base, 1½-inch binder, 2-inch covering, $2.583; asphalt, 5-inch concrete base, 1½-inch binder, 2-inch covering, $2.535; granite, 6-inch concrete base, sand in interstices, $2.18; granite, 5-inch sand foundation, $1.82; brick, 6-inch concrete, 1½-inch, sand cushion, cement grout, $2.15; brick, 6-inch concrete, 1½-inch sand cushion, tar filling, $2.23; brick, 6-inch concrete, 1½-inch sand cushion, sand filling, $2.14. The price bid per square yard includes the necessary excavation, removal of old paving material, if any, old curb and bridge stone, if so ordered, all to the city yard with the exception of the soil.

Grading and curbing, 10,423 feet, cost $19,-299.90; flagging sidewalks, 6,772 feet of street, $599.12, making a total of $703,978.86 for street improvements. Public sewers: Brick, 1,097 feet; pipe, 26,765 feet; total, 27,-862 feet, including forty catch basins and 175 manholes, at a cost of $30,400, not including inspection. Private sewers, 2,750 feet, one basin and fifteen manholes.

On the subject of street cleaning Mr. Adam says: "The purchase of six new sweeping machines, which was made last spring, has enabled me to keep the streets much cleaner than formerly, and at a less expense, and I would recommend the purchase of suitable wagons for the removal of the dirt, and to hire the teams, paying so much per load. By so doing the wagons would all be uniform in size, and I am satisfied it would be a saving in money to the city. The citizens demand that the streets shall be kept clean. This cannot be done without an increase in the appropriation, which is no more than it was five years ago. In the last two years there have been added about twenty-five miles of paved streets, and, as this appropriation is used, not only for cleaning the streets, but for repairing all paved streets, and also all work upon the unpaved streets, for maintenance of the stable, purchase of horses and wagons, tools, salary of clerks, and all incidental expenses, thus leaving but little over half for street-cleaning purposes. The income from the sale of crushed and old stone has increased this fund this year, and has enabled the department to do extra work, but next year this will not be available, and the appropriation will have to be increased if the streets are to be kept clean."

The large expenditure has only been made possible by the establishment of the capital fund scheme, which fund will, it is expected, contain something like $100,000 in the spring, so that, according to the law, about $400,000 worth of street improvements can be made during the coming year. The last installment of the $500,000 of bonds which the legislature authorized the city to issue four years ago will have been paid next year, and steps will be taken to obtain permission for further expenditures of about $100,000 a year.

MANCHESTER, N. H.—The annual report of the street commissioner shows that 22,865 feet, or 4.33 miles of new streets were built during the year ta a cost of $19,617.52, as follows: Crushed stone used in general repairs upon the streets, 4,025 loads, $19,-848.48; new concrete laid in street crossings and streets, 8,760 square yards, $4,864.65; new macadamizing laid during the year, 34,280 square yards, $12,376.81; repairing macadamized streets, $3,980.27; new paving, 9,245 square yards, $3,300.60. During the year 26,530 feet, or five miles of new sewers have been built for $66,408.87.

One of the most important features of the street department is the scavenger service.

There are nine teams in daily use collecting the waste matter about the city. These teams will average six or more loads each per day, or exceeding 17,000 loads for the year. The city farm, which has the contract for removing the perishable waste, disposes of 3,000 loads, making in all 20,000

loads of waste matter collected. The question arises for future consideration, says the report, "What disposition can be made of this accumulation of waste matter?" There are over 3,000 cesspools that require cleaning out three or four times each year, making 4,000 loads. The sweeping department collects 3,000 loads, making a total of 27,000 loads to be carted to the dumps.

YONKERS, N. Y.—A condensed statement of the streets and sewers constructed during the last ten years has been prepared by Commissioner Cooper of the department of public works. From 1886 to 1893 the city entered into ninety-six sewer and street contracts, the contract prices aggregating $771,550.31, and the cost of engineering, including plans, specifications, supervision and inspection, amounted to $44,175.25, or 5.7 per cent. From 1893, when the department of public works was organized, to December, 1896, the city has entered into 100 contracts, the contract prices agregating $1,019,564.97, and the cost of engineering, including plans, specifications, supervision and inspection, amounted to $43,134.92, or 4.2 per cent. The difference is 1.5 per cent. and on the volume of work performed it amounts to saving of $15,293.46.

There have been constructed since March 1, 1893, 6 miles of asphalt pavement, 1.4 miles of stone block pavement and 29 miles of macadam streets and roads, including those streets and roads that have been newly constructed and those that have been rebuilt. The total mileage of streets and roads in the city is: Earth 41 miles, macadam 55, asphalt 6.2, stone block, 1.8; total 104 miles. The estimated cost of repairs, mainmaintenance and reconstruction of streets and roads from March 1, 1896, to March 1, 1897, is $17,500.

There have been built since March 1, 1893, 9¾ miles of sewers, 213 catch basins and 215 manholes, making a total in the city of 31¼ miles of sewers, 497 catch basins and 862 manholes. The estimated cost of repairs, maintenance and cleaning of sewers and basins from March 1, 1896, to March 1, 1897, is $4,500.

There are on an average of ten miles of streets cleaned daily, and the cost of this work from March 1, 1896, to March 1, 1897, was $14,000. To clean all the macadam streets once a week, and those in the more populous sections twice a week, in addition to the work now done, would make the cost of street cleaning about $20,000 per annum.

BALTIMORE, Md.—The amount of money expended on the streets in 1896 was: From loans, $342,378.43; from tax levy, $201,162.82, under the law assessing benefited property-owners, $87,329.29. City Commissioner Hanway says that an inferior quality of sheet asphalt and vitrified brick has been used in street pavements, and that the city has lost much thereby. He will recommend a more general use of genuine vitrified brick and slag blocks for paving. A much larger fund will be recommended than was had last year for street repair work, as will also a change in the law regarding sidewalks, so that other sidewalks than brick may be used.

INDIANAPOLIS, Ind.—The annual report of B. J. T. Jeup, City Engineer, shows that during the last year street improvements have been made as follows:

	Miles.	Cost.
Asphalt streets	4.46	$251,048 68
Brick streets	2.34	82,099 78
Wooden block streets	3.86	270,727 12
Macadam streets	1.60	86,057 80
Gravel streets and grading	4.87	63,691 38
Gravel alleys and grading	1.60	4,640 58
Bowldered alleys and grading	1.68	290 86
Cement sidewalks	15.02	83,443 52
Brick sidewalks	3.28	6,519 90
Sewers		60,829 72
Levees		3,707 72
Total		$913,056 86

A comparison of these expenditures with those of the preceding five years since the charter went into effect shows the totals as follows: 1891, $556,152.32; 1892, $598,695.86; 1893, $1,104,037.81; 1894, $1,165,153.58; 1895, $811,464.77; 1896, $913,056.86.

Mr. Jeup is of the opinion that more asphalt will be used in the future than ever before, and recommends the use of brick in alleys only, the foundation for which shall vary from concrete to broken stone or gravel, according to the traffic. Mr. Jeup will submit to the board of public works a new kind of paving, which he has under consideration, which consists of creosoted blocks with a thin covering of asphalt.

BROOKLYN, N. Y.—Mr. Nelson P. Lewis, Engineer of Street Construction and Maintenance, in his report for 1896, says that the asphalt repaving contracted for and proposed by the common council would require an outlay of more than $2,000,000. He says:

"It has been a great disappointment that a large proportion of the work of repaving planned for the year could not be carried out for lack of funds, and a still larger amount of our cobblestone pavements stricken from the map. Of the fifty contracts for asphalt pavement enumerated in my report for last year as uncompleted, forty-four have been carried out, while eleven others for which bids were subsequently received have been finished, but six

of the contracts of 1895 will have to be carried over into 1897. Contracts have already been made for a considerable amount of repaving to be done during the next year, as follows:

	Miles.	Estimated cost.
Asphalt	8.62	$403,600
Granite.....	1.81	117,150
Brick.....	0.75	46,000

"In adidtion to these the Common Council has authorized the making of thirty-five contracts for repaving with asphalt, at an estimated cost of $369,200; six contracts for granite, amounting to about $294,000, and two for vitrified brick, estimated to cost $55,000, while they have passed resolutions of intention to repave portions of fifty-one streets with granite, at an aggregate cost of about $812,600. The total cost of repaving contracted for and proposed would thus be about $2,097,550, of which $1,072,175 would be paid for out of funds raised by the sale of local improvements bonds, and the remainder advanced out of the assessment fund until the assessments can be laid and collected. As there is now but $267,400 available in the local improvement fund, and it is uncertain when more bonds will be issued, it will be seen that the prospect of carrying out the street improvements at present contemplated is not bright, to say nothing of additional repaving which will probably be asked for within the next few months, and the much-needed repaving of certain thoroughfares which must be done wholly at the expense of the city."

Mr. Lewis strongly advocates the making of contracts for maintaining asphalt pavements in repair for a longer period than is customary. There are now 12.39 miles of asphalt pavement in Brooklyn on which the guarantee has expired.

The report also deprecates the frequent openings made in newly paved streets and calls special attention to the fact that within one month after the completion of the asphalt pavement in Jefferson avenue, between Bedford and Nostrand avenues, eight repairs to water pipes were made, making necessary sixteen openings in the pavement. "The department," Mr. Lewis says, "should certainly have the right to insist that these repairs are made, and if the property-owners fail to do so they should be made by the city, and the cost of the same become a lien on the property."

The total amount of the new construction for the year is shown by the subjoined table:

	Miles.	Cost.
Asphalt paving.....	9.54	$394,000
Granite paving.....	1.65	89,214
Vitrified brick paving.	0.17	7,800
Belgian block paving.	1.12	40,900
Cobblestone paving...	2.20	37,500
Macadamizing	6.40	145,635
Concrete sidewalks....	465,000 sq. ft.	93,000
Flagging...	400,000 sq. ft.	68,000
		$876,049

Cobblestone paving is still carried on in Brooklyn. On the subject of repairs to such pavements, Engineer Lewis takes a sound position, saying: "It is certainly poor economy to keep on repairing these cobblestone pavements year by year."

Mayor Wurster in his message said: "The disastrous result of the experiment of laying brick pavement in McDonough street has prevented any great desire for this pavement." This language seems somewhat too emphatic when compared with the report of Mr. Lewis, who says on this subject: "Very little brick pavement has been laid during the year. Early in the spring complaints were received of a disagreeable noise coming from the pavement laid in McDonough street last year. As the season advanced these complaints were more frequent, and a careful investigation was made to determine if possible the cause of the noise, which may be described as a rumbling or roar whenever wagons passed over the surface, especially if moving rapidly. I became convinced that the trouble was due to the fact that the block between Tompkins and Throop avenues was laid in December, and not completed until after severely cold weather had set in. The sand cushion thus became frozen, and although we had though that the frost was all out when the pavement was finally rolled and grouted, a considerable portion of the sand was undoubtedly frozen at that time. As this frost gradually drew out, and the sand cushion resumed its normal volume, voids were left beneath the pavement, which gave rise to this noise. Efforts were made to remedy the difficulty—first, by thoroughly rolling the pavement with a fifteen-ton steam roller, which was repeated after the removal of a strip of the pavement along the curb. The roller made no impression whatever upon the surface, showing thereby that the work done was of an excellent character. It was finally concluded to take up the brick and substitute asphalt in its place, which has been done. This incident has, of course, created a prejudice against brick pavement which it will take a long time to overcome. Several important contracts have been made for laying brick pavements; but it is impossible to carry them out this year. I am confident that the disagreeable features of the McDonough street pavement will be avoided."

LETTERS FOR THE PUBLIC.

COST OF ASPHALT PAVEMENTS IN BROOKLYN.

To the Editor of Municipal Engineering:

The facts given below with regard to the asphalt pavement which was laid in Brooklyn during the year 1896 may be of interest to your readers, as I think that the cost of the work was exceptionally low.

The amount laid was 9.86 miles, at a total cost, including the removal of old pavement, regrading, foundation, curb and everything except inspection and engineering, of $390,590.39. This does not include 3,806 feet laid over old stone pavement by the park department amounting to 13,302 square yards and costing $19,230.31 Other details are as follows:

Average cost per mile, including curb and foundation	$39,613.63
Maximum price per square yard for asphalt surface (Railroad street).	1.52
Minimum price per square yard for asphalt surface	1.00
Average price	1.16
The maximum price per square yard, including foundation, curb, etc	2.81
The lowest price as above with concrete foundation	1.97
The lowest price laid over old stone pavement	1.58
The average cost per square yard of all work done, including foundation, curb, etc	2.04

The foundation consisted in the majority of cases of five inches of Rosendale cement concrete, though in a number of cases the foundation was six inches in thickness. The cost of the concrete varied from $3.60 to $4.20 per cubic yard, and the work was in almost all cases very satisfactory.

The largest proportion of the contracts were for Trinidad Pitch Lake asphalt, though Alcatraz, Bermudez and Trinidad land asphalts were also laid. One of the contracts was for repaving a block upon which vitrified brick had been laid a year before, but owing to the numerous complaints of rumbling caused by vehicles passing over the brick it was removed and asphalt substituted.

N. P. LEWIS,
Engineer of Street Construction and Maintenance.

Brooklyn, N. Y., Jan. 11.

ENGINEERING EXPERIMENT STATIONS.

To the Editor of Municipal Engineering:

I note your recent article in the bill to establish engineering experiment stations in the different states and your suggestion of a single station. The reasons for placing the stations in each state are that they are intended not for research alone, but for the testing and inspection of materials as well, especially with reference to what are known as the materials of construction. In the latter case the single large station would be of little, if any, use, except to the people in the immediate vicinity of the station. It would not pay to send the specimens any great distance, and particularly would it be expensive if, as so often happens, the parties having the testing done desired to witness the tests.

The government and state supervision and tests of the quality of material has given most excellent results not only abroad but wherever it has been tried in this country, and the further extension of the system is unquestionably needed.

When we consider the value of the laboratory from the standpoint of original research, the central laboratory would be of great use in investigating questions of general application, but would be of little use except in its immediate neighborhood as far as the industrial development of the country was concerned.

The man who wanted to have a machine carefully tested would think twice before shipping it from, say San Francisco and back and paying his own fare in case he wanted to witness the tests.

The research laboratory, it is proposed, should do work exactly similar to that of the agricultural experiment stations, the value of which has been so fully determined.

The primary object of the engineering experiment station is not the solution of engineering problems alone, but the development of the industrial possibilities of the different states and the furnishing of reliable bureaus for testing and inspection of materials. Very truly yours,

L. S. RANDOLPH.

Blacksburg, Va., Jan. 2.

THE FIRST BRICK-PAVED COUNTRY ROAD.

To the Editor of Municipal Engineering:

I see that you make the assertion that a brick-paved road near Monmouth, Ill., is the first instance of a "brick-paved road in the United States." If you will write to the

County Surveyor of Cuyahoga county, Ohio, at Cleveland, I think he will inform you that such a road was constructed in that county about three years ago, and possibly can give you some notes as to its durability, usefulness and cost. I am very much pleased with your magazine, not only the varied contents, but also its handy book form. C. H. SNOW.

Elyria, O., Jan. 8.

ASPHALT ON COBBLESTONES IN PHILADELPHIA.

To the Editor of Municipal Engineering:

In accordance with a resolution recently adopted in Councils, the members of the committee on highways left for New York City yesterday to "investigate the question of surfacing with sheet asphaltum streets now paved with rubble or cobble stones, and if found to be practical, to report to Councils the result of such investigation with probable saving to the city in the cost of repaving streets in the manner proposed. The cost of such investigation is not to exceed $1,000."

It was stated, when the subject of the investigation was discussed, that this is successfully done in New York City, and that, if practicable, it would prove a great saving to the city, obviating the expense of tearing up the old pavements and of laying new foundations. Therefore, the committee decided to go over and see for themselves how it is done.

Incidentally, it is said, the committee will inquire into the bicycle paths which are said to be maintained on the streets of New York, with a view to the adoption of similar scheme here. W. S. GODWIN & CO.

Philadelphia, Jan. 19.

SELECTIONS FROM THE PRESS.

PUBLIC WORKS IN PARIS AND LONDON.

Gen. C. H. T. Collis, Commissioner of Public Works in New York City, who recently visited London and Paris for the purpose of gathering information regarding public work in those cities, on his return wrote an account of his observations for the New York Sun, from which extracts are reproduced as follows:

FOUR DAYS IN PARIS.

Of the four days spent by me in Paris I devoted two to the subject of pavements and the other two to drainage, water supply, revenue, lighting and street transportation.

The streets of Paris are of three classes. First, those that belong to the whole people of France, which may be called national highways; second, those that are solely municipal streets, and third, those that have been laid out by private owners and are not accepted by the city until all the drainage, water pipes, pavements, etc., have been laid at the cost of the owner of the property. All work done by the proprietors mentioned in this last class is under the supervision and according to the formula of the municipal authorities. The Rue de Rivoli, for instance, is a national highway, and all money expended upon it, whether for paving or for cleaning or for drainage, is shared between the national government and the city government in proportions which I have not been able to ascertain. The Avenue de l'Opera, on the other hand, is a municipal street, and all these expenses are paid by the municipal government.

The pavements of Paris are of several kinds—the macadam, stone blocks (known in America as Belgian blocks), the granite, "le gres" (known in America as the ordinary granite pavement), the wooden pavement, the sheet asphalt, and recently the block asphalt, which is used in the uptown streets of New York, so that Paris may be said to be paved with harlequin pavement, wood largely predominating for the last three years.

The macadam pavement was introduced during the late empire. In the revolution the Belgian block was availed of by the people for erecting barricades, for which they were admirably adapted, and the macadam pavement, composed of small stones and sand crushed and rolled together, removed this menace to the powers that were, but the granite blocks were permitted to remain alongside the curb to form a gutter. About this same time, however, the great sewer system of Paris was being constructed, and it was found that one of the principal difficulties under which the sewers would labor would be the washing by rains of the macadam surface into the sewer basins and then to the underground system. In addition to this, experience taught that these pavements were not sufficiently durable to resist the heavy traffic in circulation in the streets of Paris, the injury to the roads requiring constant repair, making the maintenance of them very expensive (about 50 cents a square yard annually for repairs). It therefore became important to look for a substitute, and then the pavements which are called in New York the granite pavements, such as is now in use on Fifth avenue, were introduced. This was laid on seven inches of sand without any concrete foundation. It did not take long, however, to develop the fact that sand was not a sufficiently strong foundation for such a pavement, since when many of such pavements have been laid on concrete as a foundation. These pavements are not only exceedingly noisy,

but the interstices between the blocks receive and retain decayed vegetable and animal matter for long periods of time, creating in the summer unpleasant odors and exciting the criticism of the medical faculty. As the Parisian government is very careful about such matters, it has during late years been laying pavements which shall have substantially a smooth and even surface from curb to curb. In fact, owing to the poor foundation and the large joints of these granite pavements, and particularly wearing at the corners, holes and ruts have formed, making them very much resemble the old-fashioned cobblestone pavement. These pavements when laid upon about six inches of concrete and a little cushion of sand cost $3.50 a square yard. They are laid by the city itself and not by a contractor; therefore, the $3.50 does not include any guarantee for maintenance. Our granite pavements in New York cost avout the same amount but this cost carries with it a guarantee of two years' maintenance.

Asphalt pavements have been in use in Paris for thirty years, but never on a very great scale. (It is not the same kind of asphalt used in America. It contains no sand. —Editor M. E.) There is, however, a great prejudice against asphalt in Paris owing to its slipperiness, which is in a measure overcome by constant sprinkling of a mixture of crushed stone and sand, the quality of this composition depending very much upon the grade of the street. This method is objectionable because it results in a quantity of soil being carried into the sewers.

The wooden pavements are made of all kinds of wood from every part of the world. The wooden blocks are laid upon six inches of concrete without any sand cushion, with very wide joints filled with a very liquid cement of fine gravel and bitumen. The cost of the wooden surface itself, not including the concrete, varies from $2 to $4.75 a square yard, according to the material and traffic. At all elections, since wooden pavements were introduced in Paris, the candidates for the Municipal Council have found it to their advantage to pledge themselves to the construction of wooden pavements in the streets running through their respective districts. This has resulted in the laying of many pavements of a very poor quality of wood. I have traversed a good deal of it myself, and have found many pavements of this kind, which I can only describe as being exceedingly "bumpy," that is to say, a person riding over it in a cab experiences very much the same motion he would in riding over a badly paved granite street in New York. They are, of course, very noiseless. There is now growing up a prejudice against these wooden pavements, especially among medical men. Originally, the joints between these blocks were filled with bitumen; this howevr, wore out or crumbled, and they now substitute a very liquified cement, but, owing to the porous character of the wood, there is a constant absorption of liquid in wet weather, and in summer time the heat so expands the blocks that it has become necessary to leave a space of about 3½ inches between the pavement and the curb to allow for expansion, and these spaces are filled with ordinary green clay, because any harder material would offer no opportunity for the expansion of the blocks. The result of this is that quantities of animal and vegetable matter become deposited between the pavement and the curb which the brushes of the street cleaner cannot reach. About three months ago some men occupied in removing this clay were attacked with an illness which indisputably came from the microbes generated in these deposits.

The most recent pavement being tried in Paris is the asphalt block pavement, similar to that which is laid in the upper parts of the city of New York. I saw it on the Rue St. Martin, behind the Tour St. Jacques, and that was the only street, whether granite, asphalt or wood, which I did not see sanded. I am told that two eminent government engineers, Messrs. Geng and Rouleau, have reported it absolutely non glissant. These blocks are laid on six inches of concrete up to the curb, as they are not liable to the influences of the weather causing either contraction or expansion. They are laid very flat, perhaps too much so, having hardly any crown in the center. In addition to the concrete they have a cushion of 1¾ inches of sand. The joints are filled in with white sand which comes from Fontainebleau and is known as hour-glass sand, because used by the ancients in their hour glasses. This sand is put in dry, without any admixture of bitumen or cement. There has not been a sufficient lapse of time to give this new pavement a good test. The one I saw has been laid about three months on a street of very heavy traffic, and it certainly has not shown any effects of wear up to this time.

I should say, from what I saw and heard, that Paris is just as much in a condition of perplexity as to the respective merits of the various modern pavements as we are. Slipperiness is the most annoying and difficult problem to solve. Every sidewalk in Paris, excepting those where the roadway is macadam, is encumbered by deposits, at intervals of about three blocks, of two cubic yards of sand, neatly and shapely trimmed, it is true, but too unsightly to be tolerated in an American city, which is consumed daily in making a rough surface by sprinkling, over which horse may safely travel. In some places small broken stone about the size of a bean is used instead of sand, and when pulverized by the traffic forms an admirable foothold. When the rain comes, however, as it does come more or less every day at this season, all this earth is converted into a slushy mud, which remains upon the surface until the street cleaner sweeps it into the sewer basins in the early morning, and then for a few hours Paris looks sweet and clean. This mud is carried by pedestrians into omnibuses, cabs, shops and hotels. The only people who don't seem to care a gaiter button for it are the women, who never permit their petticoats to come within six inches of the pavement.

I think our new pavements are better laid than those in Paris, but we are a long way behind them in repair and maintenance. The method of repair is simple and unique. Repair gangs on the wooden pavements consist of three men, a hand-drawn cart full of blocks, a wheelbarrow full of sand, two crowbars, a hammer, a watering

pot and a broom. One man removes the old blocks, another assorts the material, and the third, who is a skilled mechanic, kneels at his work as a cabinetmaker or a joiner would in laying a hard-wood floor. A thickness of about one inch of cement is first carefuly laid over the old concrete, and when the blocks are in position the man with the watering pot floods the whole with a very thin mixture of the same material.

For the year 1896 the sum of fourteen millions four hundred and five thousand francs (nearly three millions of dollars) has been appropriated for the maintenance and repair of streets and sidewalks. This does not include street cleaning. In some of the streets, for long distances I observed three distinct kinds of pavement—granite, macadam and wood—but for what reason no person seemed able to inform me, unless it was to test their respective durability. It certainly was not attractive or comfortable.

With the sewer system of Paris, of course, the whole world is familiar. I had the good fortune (thanks to Mayor Strong's letter) to be taken through by a government official and an interpreter during a season when the public are not admitted, thereby giving me an opportunity not only thoroughly to examine, but thoroughly to inquire. These sewers are 722 miles in extent, and, under a new law, 12,000 houses have, so far, been directly connected with them. Everything but garbage is carried away by these sewers, including the sweepings of the streets, which avoids the necessity of carting away the sweepings as we have to do in New York, and renders the problem of keeping the streets clean easy in comparison to ours; yet they are not nearly so clean, although Paris pays annually $1,843,930 for street cleaning and sprinkling with water.

Formerly all the drainage of the sewers was emptied into the Seine, but now the sewage is deposited on sandy plains in the suburbs, which are thus being converted into fertile tracts of land. These localities are Gennevilliers and Acheres; the tracts are called champs d'epandage (impounding fields); this land is of great extent, and produces all the domestic vegetables except salads, which, I discover, require sprinkling with water on the top to bring them to the high standard demanded by the French palate.

This underground sewage system of Paris furnishes occupation to 1,000 men in constant employment. The distribution of the sewage over these lands is an exact counterpart of the American system of irrigation in the Western country. That is to say, the sewage flows through ditches, and vegetables grow upon the banks which are percolated by the drainage filtered as it passes through the earth. The underground sewers of Paris contain thousands upon thousands of what I may describe as waterfalls, ducts through which water is automatically, at regular intervals, precipitated with great force into the main channels of the sewer, giving additional velocity to that which the liquid in the sewer acquires from the grade. I saw this in operation, and it very much resembled the force which comes from an ordinary fire hydrant when turned on at full head, excepting that the volume of water is much larger. Every one of the 12,000 houses referred to has a separate connection with the sewer large enough for a man to work in, and fitted with a gate which can, if necessary, cut the house entirely off from the system, thus enabling the owner or occupant to clean or overhaul the internal drainage without any contamination by gas or otherwise from the sewage system itself. (Many houses, however, in certain districts are still dependent upon the old cesspool system.)

Parisians live in flats, one floor above the other, each flat being, as with us, a complete house. In addition to the safety against escape of gases in these apartments there is an additional trap at the basement beneath the street. This is required by the government.

The water supply of Paris is a monopoly concession to a private corporation, subject, however, to a municipal regulation, and this has been the case for at least half a century. There are two kinds of water supplied to the city by this company, one from springs collected into vast reservoirs and used for domestic purposes, and the other taken directly from the River Seine, which is used for sprinkling the streets, flushing the sewers and all other municipal purposes. However, during the summer droughts, which are of frequent occurrence, the river water is substituted in certain sections of the city for a few days at a time for domestic purposes, notices being first posted indicating the time when the change will take place. It is safe to say that Paris is not so bountifully supplied with pure water as she should be, and there are several projects for supply under consideration, one reaching as far as Lake Geneva in Switzerland. Another suggestion is that it should be taken from the Rhine, but this would put Paris so strategically at the mercy of Germany that it is not seriously entertained. Every house in Paris using water, whether for busines or domestic purposes, measures the water through a meter, which is read at intervals of one month.

OBSERVATIONS IN LONDON.

Strange as it may appear, it was more difficult to get information in London than in Paris. Perhaps I didn't happen to hit just as well. Nevertheless, Mayor Strong's letter put Mr. David J. Ross, Chief Engineer of the Commissioners of Sewers, and Mr. Alexander R. Binnie, Chief Engineer of the London County Council, entirely at my service. I found them both delightfully courteous, and had pleasant and instructive interviews with them, during which they placed the entire force of their respective departments at my disposal. My time being limited, however, to a copule of days, I had to catch my information on the fly, so to speak.

The city of London proper is, as a general thing, paved with sheet asphalt, wooden pavements being in general use in the Metropolitan district or county. The authorities of these respective territories differ widely as to the merits of these two pavements. Mr. Ross, over whose streets there is an immense amount of what may be called show traffic, says he has not yet seen anything which he is willing to substitute for asphalt; in fact, many streets of the city heretofore paved with wood have recently been paved with asphalt, notably

Foster lane, Austin Friars, King Edward street, and Beech street.

Mr. Ross kindly furnished me with several reports of his own upon the subject of street paving, but he called my attention to that of his predecessor, Mr. William Haywood, whose eminence and high character sufficiently guarantees the conscientiousness of his conclusions. Mr. Haywood tells us that Cheapside was laid with asphalt in 1870, and though it had been extensively repaired, the immense traffic had never once been delayed for this purpose in seventeen years, when it was again resurfaced with asphalt. In 1848 the principal thoroughfares of the city were all paved with wood, but this proving unsatisfactory, they were all taken up and replaced with granite; but the uproar of the omnibuses, cabs and other vehicles caused a popular uproar, which led to the laying of 400 square yards of asphalt by the Val de Travers Company, as an experiment, in the carriageway of Threadneedle street.

Remarkable to relate, though this pavement was laid in 1860, it still remains in good condition, though of course it has undergone repair from time to time. The cleanliness and noiselessness of this little piece of pavement enlisted the favorable opinion of the public, though great objection was made to it on the score of its slipperiness, and it has since been laid on nearly twenty miles of streets burdened with perhaps the most continuous and unbroken traffic in the world. Mr. Haywood says: "The wood pavement laid in several streets within the last twelve years (1878 to 1888) has been taken up and replaced with asphalt, but there is no instance that I can remember of an asphalt pavement having been taken up and replaced with wood within the city of London." And Mr. Ross, his successor and present incumbent, confirms this statement up to date.

On the subject of slipperiness, Mr. Haywood, probably the very best authority upon the subject, after careful study (which duty was imposed upon him by the Commissioners of Sewers) reported as follows:

"Complaints of the slipperiness of asphalt are certainly not so numerous as was formerly the case. This is perhaps attributable in a degree to the greater cleanliness that is maintained in the city streets, as well as strewing the pavements with sand and other material, which is extensively done when they are found to be slippery, owing to rain or the state of the atmosphere, but it is, I think, largely due to the horses having become accustomed to traveling on asphalt, and therefore moving over it with greater safety to themselves."

I have always believed that the slipperiness of the asphalt pavements in New York was attributable to our great variety of pavements, rendering it necessary that a horse should change his gait and the planting of his hoof at every change of pavement, and that when New York became an asphalted city this intelligent animal would adapt himself to it. To those who are skeptical as to the ability of asphalt to resist the wear and tear of street traffic I may say that on Cheapside 13,772 vehicles pass every twenty-four hours; in Mansion House-st. 23,332, over Holborn viaduct 12,762, Newgate-st. 11.967, and Queen Victoria-st. 10,895. All these streets are paved with asphalt, and they average in width less than forty feet from curb to curb. In view of all this Mr. Engineer Ross tells me "I would not change from asphalt to any other material if I could." One very serious objection he made to wood was its liability to contract and expand. In some instances it had ripped the curbs entirely out of place. On the other hand, however, Mr. George Livingstone, the surveyor of the district of St. George (the territory which to an American is best located by saying that Piccadilly is a part of it), expressed himself to me as preferring wood, though he concedes the superiority of asphalt for cleanliness and facility for repairing. When asked whether, as a matter of hygiene, the mineral did not also have an advantage over the vegetable pavement, he doubted it, and being evidently a very fair man, I was impressed with his flat contradiction of the theory that the wooden blocks absorbed moisture, which under the rays of the sun produced unpleasant odors and deleterious gases. Nobody is prepared to deny that the wooden pavement under certain conditions is as slippery as asphalt; on the contrary, they are both treated with sand sprinkling in the same manner; but it is true that many eminent experts upon the subject of street paving, notably Lewis H. Isaacs, surveyor for the Holborn district, are unequivocally opposed to vegetable pavements, and that the medical faculty is very much exercised about the matter. Mr. Issacs frankly admits that wood has many advantages.

"First," he says, "it is as yet absolutely the least noisy of all pavements. Second, it gives the minimum of friction, with the exception of asphalt. Third, it is comparatively clean, as, if properly formed, it should make little or no dirt. Fourth, in the event of a horse falling on it, he can rise more easily than on a granite or asphalt pavement." But he says never a word about what it would look like after two or three New York gas companies had had a hack at it.

Dr. Louis C. Parker, the Health Officer of Chelsea, says: "The paving of the main London streets with wood is a nuisance and a danger to the public health. The putrid vapors generated on the surface of wood pavements are constantly present in the atmosphere." He adds that, while it may be true that the atmosphere of a stable is not unhealthful, yet no man wants to live on it continually. Yet he admits that, excepting for sanitary reasons, wood forms an almost ideal pavement.

The first cost of laying wood pavement in London, nearly all of which is of ordinary pine blocks, pickled in creosote, is about $2.12 a square yard and about 25 cents a square yard annually for maintenance and repairs, which for fifteen years' maintenance would bring the cost up to $5.87 a yard. The first cost of asphalt is $3.63 a square yard and 25 cents per annum for maintenance, which would make the cost on a fifteen-year guarantee equal to $7.38.

In the city of New York I am laying an asphalt pavement on Fifth avenue which has a deeper concrete foundation than that required by the Paris or London formula and will probably be the best pavement in the world, yet it costs the city, with a

fifteen-year guarantee of maintenance only $4.60 a yard. Why this is thus I do not know, but the facts are indisputable.

The Jarrah and Karri woods of Australia the used only here and there, their cost being almost prohibitive and their hardness making them almost as noisy as the old granite pavements. They have been removed by the Kensington Vestry from Brompton road and creosoted deal (pine) blocks substituted.

The following table showing the comparative merits of the different kinds of pavement now in vogue in Europe (excepting macadam) was promulgated after close scientific investigation, and is very interesting:

	First.	Second.	Third.
Public Hygiene...	Asphalt	Granite	Wood
Noiselessness	Wood	Asphalt	Granite
Safety for horses (unless where streets are well cleaned)	Wood	Asphalt	Granite
Cleansing	Asphalt	Granite	Wood
Durability	Granite	Asphalt	Wood
Economy	Granite	Wood	Asphalt
Facility for repairs	Asphalt	Wood	Granite

Thus we find that asphalt is regarded as taking the lead in the three qualities most desirable for a pavement in New York, viz.: hygiene, cleansing and facility for repairs.

Greater London, by which term I mean to include both the city and the county, covering an area of 620 square miles, and having a population of five and a half millions of souls, is dependent upon eight private companies for its supply of water for domestic and all other purposes. This water, being under private proprietorship, is not so bountifully distributed as with us. These five and a half millions of people consume only 182,500,000 gallons a day, 20 per cent. of which is used for public and trade purposes, so that the citizens of London are permitted to use only 25 gallons a head a day, whereas in New York two millions of people consume 230,000,000 gallons, or about 110 gallons per capita. Of course much of this is wasted, but as we always have ninety days' supply on hand, whereas London is lucky when she has fifteen days, we can better afford to distribute it as a necessary than dole it out as a luxury. Our superb Croton water storage system is known to all the engineers of the world as a model system of anticipation of future needs.

STREET PAVED WITH GOLD.

It is a gelological sarcasm on the free silver state of Washington that the streets of Tacoma are paved with gold. It is found a fact that the paving stones are so rich in gold that they are to be taken up and crushed and made to pay for a beter pavement. Tacoma is the only earthly city ever discovered in such a position.—New Orleans Daily Picayune.

THE INLAND SEWAGE DISPOSAL PROBLEM.

The importance of better methods of sewage disposal for towns which derive their water supplies from rivers is strongly emphasized by F. J. Kingsley in the Water (Conn.) American. In speaking of the inland sewer problem in Connecticut, which applies equally well to other sections of the country, he says:

"The sewer problem is a very serious one for a great many towns; so many, in fact, that it seems to me it can only be adequately treated by considering it with reference to the whole state. Torrington sends down the sewage of its 8,000 people to Thomaston, which adds its 5,000, and sends the sewage of 13,000 to Waterbury, which adds its 40,000 and passes it on to Naugatuck, which adds 8,000 more, and now, with the sewage of over 60,000 people, this one small stream takes its pollution into the pond at Seymour, whence many persons do, or lately did, obtain their supply of ice; and so on to Ansonia, Derby, and the sea. But this is only one case in many. In the same manner New Britain, the Farmington valley, extending as far as Winsted, and all the Connecticut river towns, bring their filth to Hartford, whence it sometimes pumps its water supply, adds its own sewage from 75,000, and passes in on to Middletown and others below it. Danbury sends the sewage of its 20,000 through the flat meadows and sluggish waters of Still river, into the Housatonic, which, having been already contaminated by Pittsfield, Great Barrington, and all the factory villages in that neighborhood, rolls its polluted flood into the great pond at Shelton, there to settle and reek and breed microbes for the infection of the atmosphere of the clusters of cities near its borders. The same story must be told of Willimantic and Putnam, and all the villages along the Shetucket and Quinnebaug that carry their pollution down to Norwich and New London."

This leads Mr. Kingsley to the suggestion that the state legislature should establish a sewage commission, composed of experts on sanitation, engineering and law, as well as men of sound business judgment, who should be intrusted with the solution of this important problem.

MACHINERY AND TRADE.

THE CUMMER PORTABLE DRYER.

The accompanying illustration of a portable drying and heating plant particularly adapted for drying and heating sand for asphalt, for preparing crushed stone for contractors of different work requiring the stone in such a condition, is of importance as well to other classes of trade. This apparatus consists of an all-steel car 48 feet long by 9 feet 3 inches wide over all; one patent Cummer dryer complete with its furnace, etc., one twenty-five horse power engine and the necessary elevating and power transmitting machinery. The car is equipped with improved couplers, Westinghouse air brakes; and it, with the rest of the plant, has been passed upon and approved by the railroad authorities.

The dry and heater (which is of the same style as Cummer & Son's style, "Salamander," is mounted and bricked in on top of the car in a very unique and substantial manner. The fire brick, and, in fact, all brick are put in place in such a way as to make it impossible to crack or loosen them. The bottom part of the furnace and combustion chamber, or in other words, the lowest part of the dryer, is above the cowcatcher on the locomotive, so there is no danger of trouble from this source. The cut is a little misleading on this point. Two elevators are used in connection with the dryer, one to feed and one to deliver the dried and heated or simply dried material from the dryer to the screen, or to any point desired. The engine is of the Westinghouse pattern.

The operator of the machine has full control over the temperatures to which the material being treated is subjected, and it is claimed that it can be delivered dried and heated to any temperature desired between 150 and 600 degrees Fahrenheit. It is not necessary to carry a supply of hot sand or rock in a cooling bin, as the dryer delivers the necessary material heated uniformly ready for use.

The cut was made from a photograph recently taken of a plant built for a very large asphalt company, to be used by them as part of an asphalt plant. The sand drying and heating plant has a capacity for turning out about fifteen tons of sand per hour and for laying 1,200 to 1,500 yards of pavement in ten hours. Its capacity is equal to any stationary plant.

The Cummer Company build these plants in several different sizes and styles. First, they make their regular standard portable plant, which is complete in every detail. This plant includes three cars. The portable dryer with engine, elevators, screen, etc., is car No. 1. On this car may also be placed a crusher and pulverizer for making the fine carbonate. Car No. 2 carries the melting and mixing tanks, the boiler (which furnishes the steam for the engine and for melting the asphalt), the mixer for mixing the carbonate, sand and asphalt, air and oil tanks, air pumps, etc. This outfit is complete and has a capacity fully equal to the dryer. Car No. 3 is a box car especially fitted so that one compartment is a store house for tools, and there are other compartments with sleeping bunks and an office room. Secondly, this company make what they style their regular portable plant. This is a cheaper plant, and is mounted on three ordinary flat cars. This plant has the same capacity as the standard, but costs less. Both the standard and regular plants are made with different capacities. Still a third style of plant is made by the Cummer company which they call "semi-portable," capacity from 500 to 1,500 yards daily. It is intended that this plant shall be transported from city to city as ordinary freight on cars belonging to the railroads, and at destination that the plant shall be removed entirely from the cars. Its parts are of such size and weight that they may be transferred to trucks for transportation to any part of any city that would be available for use and nearest to the work to be done.

The different parts of the semi-portable plant are so designed and constructed that erection and dismantling of the same and reloading for transportation to another city is not a serious matter. The Cummer Company recommend the use of this plant only when yard room cannot be obtained available for the use of a standard or a regular plant. The company claims to be quite capable to design and furnish any special construction that may be necessary or desirable. They state that they designed and constructed their first plant and delivered it to the purchasers within four months after taking the contract, "and," they say, "the first plant was so successful in every respect, exceeded the guarantees so much

CUMMER SAND DRYER FOR PORTABLE ASPHALT PLANTS.

and was so satisfactory that a second plant was ordered almost immediately. These plants have been in continuous operation or nearly so since they were started. The first plant has been in use about nine months."

The Cummer Company are pushing their business into all parts of the world. They make a great variety of drying machines, and their machines are in actual use drying, roasting and calcining all of the following materials: Sand, sawdust, brewers' grains, impalpable silica or quartz, asbestos, wood pulp, bones, ores of all kinds, kaolin, digested hair, distillery slop, concentrates, marl, fertilizers, starch feed, all very wet and sticky materials, chalk, bi-products, all grains, clays of all kinds, muck, brick, coal, lignite, infusorial earth, rubber, terra cotta, peat, paint stocks, phosphate, cement briquettes, guano, wood chips, blood, tile, pottery, tobacco, chemicals, tankage, salt, cotton, moss, nitrate of soda, carbonate of soda, gypsum, copra, wool, yarn, cloth, cocoa, garbage, sewage, night soil.

A NEW DISINFECTING PLANT.

The Sanitary Construction company of New York, whose president, W. F. Morse, is an authority on sanitation and disinfection, is constructing a new disinfecting plant at E. Sixteenth-st. and the river bank, in New York City, under the direction of the Board of Health. It is claimed that when finished it will be the finest plant of the kind in the world. It comprises two steel chambers and a formalin chamber, which is to be used for the disinfection of costly and fine fabrics. This formalin chamber, the first to be constructed in the world, opens up a new chapter in the science of disinfection. This new gas, which is scientifically known as formaldic acid gas ("formalin" really being a 40-per-cent. solution of it), may be a discovery scarcely less valuable than steam as a disinfectant. It is most effectively produced by dehydrogenating alcohol, and is a discovery of the Germans. Active experimenting has been going on for a number of months to learn its possibilities. Its value as a disinfectant, it is thought, may prove great. Despite the experiments now being made in various laboratories, however, this apparatus designed by Dr. Biggs is the first to be put to practical use.

In size the formalin chamber will be 6 by 7 by 4 feet, large enough to take within its maw any piece of upholstered furniture. The process of disinfecting with it is simple. A partial vacuum is produced, and by heat the gas is discharged from the "generator" into the chamber. Compared with sulphuric acid gas, which has been in use a number of years, or ever since the science of disinfection really began to be of practical value, it is a better germicide and has no effect at all upon the texture and the colors of fabrics.

There are two cars in the chambers. These cars run on tracks that by a curious device can be turned down and put on a level with the floor, when the cars are locked within the chambers. The chambers themselves are built in two rooms which do not communicate with each other. When the dry steam has done its work the doors of the chambers in the room beyond will be opened, and the cars pulled out there with the germs completely destroyed.

Inside each chamber are coils of steam pipes, directly connected with the apparatus, for exhausting the air from the interior of the chamber, pipes for admitting steam under reduced pressure, and a large pipe connecting with powerful fans and radiating steam-heating coils furnishing blasts of hot air.

As there are upward of 60,000 articles disinfected every year in New York the economical possibilities of a successful plant of this kind are large.

PROPOSED COMBINATION OF SEWER PIPE MANUFACTURERS.

It is reported that another effort is being made by sewer pipe manufacturers of Akron, O., and other like manufacturers of other cities, to effect what is known as a sales company, similar to that of the nail and other trusts. Although the plan has been adopted by many manufacturing interests, it is declared illegal by the attorney-general of the United States and by most legislatures of the different states, the most recent of which is Georgia, where every trust company operating has succumbed to the law passed by the Georgia legislature relative to trusts, and such action is becoming general.

RECENT INVENTIONS.

[Reported specially for MUNICIPAL ENGINEERING, by A. I. Gardner, Attorney at Law and Solicitor of Patents, Loan and Trust Building, Washington, D. C. Copies of any patent can be secured for ten cents each.]

572,640. Street Sprinkler. H. W. Knight, Toledo, O. A centrifugal water sprayer, comprising a vertical shaft, a horizontal disk rigid therewith, radial buckets arranged on the upper face thereof, a horizontal plate having an open center and resting on the buckets and the water-dis-

tributing chamber loose on the shaft in said open center and having a perforated bottom.

572,791. Street Sweeper. A. Gartner, Newark, N. J.

573,243. Road Planer. J. C. Steele, Vaughan, Canada.

572,995. Water Tower. W. H. Jackson and B. N. Moss, Des Moines, Ia.

573,757. Roadway. A. Bliss, New Lenox, Ill. A rail for roadways, comprising the flat portion having two depending parallel flanges adapted to be set into the earth, in combination with the fish-plate for connecting the ends of two rails and having the inclined laterally-extending flanges.

TRADE NOTES.

The purchase of a steam road roller is contemplated at Waukesha, Wis.

The Imperial Shale Paving Brick Company, Canton, O., has resumed work.

The Nelsonville Sewer Pipe Works, Nelsonville, O., wer destroyed by fire Dec. 30.

The members of the city council, Omaha, Neb., contemplate the purchase of a street sweeper.

The Michigan Pipe Company, Bay City, Mich., was completely destroyed by fire Dec. 16.

The purchase of a stret sweeper has been decided upon at Winston, N. C. Address T. J. Wilson.

The purchase of a stone crusher has been recommended by Mayor Mather at Easthampton, Mass.

The erection of sewer pipe works, at Chester, Va., is contemplated by the Chester Clay Working Company.

During the last month the Gates Iron Works of Chicago shipped thirteen car loads of machinery to South Africa.

An ordinance has been introduced by Councilman Buckman at Eaton, Pa., for making an appropriation of $4,000 for a steam road roller.

The California Stone and Brick Company has been organized at San Francisco, Cal., to manufacture brick from sand, crushed stone and clay.

The Smith Paving and Supply Company, Charleston, S. C., has been incorporated by George Smith, D. Van Smith and John D. Gadsden.

The Union Contracting and Construction Company, Trenton, N. J., has been incorporated to conduct a general contracting business, by James J. Cahill, Erwin E. Marshall and Lawrence Braden.

The J. F. Olmstead Cement and Paving Company, Chicago, Ill., is a recent corporation by J. F. Olmstead, W. H. Fellows and A. C. Warren.

The Litho-Carbon Rubber Company of New York and San Antonio, Tex., has assigned to Ralph T. Ropeky, vice-president of the company.

A device is being made by the Rossman & Bracker Company, 134 E. Forty-second street, New York City, for testing the tightness of sewerage plumbing work of houses and other buildings.

The George G. Chapline Construction Company has been incorporated at St. Louis, Mo., by Geo. G. Chapline, Harry G. Parsons and S. A. Keedy.

The Stockton Stone Company has been incorporated at Jersey City, N. J., to quarry and manufacture stone, by B. M. & J. F. Shanley of Newark, and Robert A. Montgomery of Lambertville.

Fraser & Chalmers, Chicago, Ill., have sold and erected a pumping plant for the Hamilton shaft of the Chapin mine, at Iron Mountain, Mich. It required thirteen cars to transport the plant from Chicago to the mines.

Officers have been elected in the Central New York Drain Tile and Brick Company, at Chittenango, N. Y., as follows: President, O. S. Foster, Utica; vice-president, A. D. Perry, Syracuse; secretary and treasurer, F. H. Ebeling.

The Owen Sound Portland Cement Company has elected officers for the current year, as follows: President, John Lucas, Toronto, Can.; Vice-President, J. E. Murphy; Manager, R. P. Buchart; Director, W. P. Pierson; Secretary and Treasurer, George S. Kilbourn.

The Bermudez Paving Company, Syracuse, N. Y., elected officers Jan. 13, as follows: President, P. R. Quinlan; Vice-president, C. D. Beebe; Treasurer, W. A. Hill. Board of Directors, W. A. Hill, C. D. Beebe, P. R. Quinlan, P. H. Holleran and Edward Ryan.

The stockholders of the Red Wing Sewer Company, Red Wing, Minn., held their annual meeting Jan. 13, and elected officers and directors as follows: President, E. H. Blodgett; vice-president, A. G. Henderson; treasurer, F. Busch; secretary and general manager, C. E. Sheldon; directors, E. H. Blodgett, T. B. Sheldon, E. W. Brooks, A. G. Henderson, T. J. Bjorugaard and F. Busch.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

New Britain, Conn.—The resolution which provided that no asphalt streets shall be laid unless one-half the abutting property-owners consent has been vetoed by Mayor Vance, and the veto has been sustained.

Newark, N. J.—The commission appointed by the supreme court has decided to assess the benefits for the Clinton avenue paving at the same figure that the Board of Assessment Commissioners decided on.

Kansas City Mo.—The Parker-Washington Paving company, which secured the contract Oct. 25 for paving Broadway, from Sixteenth to Twenty-first streets, has been notified to make a bond by Feb. 1, or the contract may be annulled. The company has completed the pavement on Washington street, from Tenth to Thirteenth, but it has not yet been accepted by the city.

Joliet, Ill.—The issues suggested for the spring election of city officers are: Macadamized streets and street sprinkling by general taxation; a comprehensive and effective system of sewerage and drainage; conservation of the water supply by the adoption of the meter system; an acceptable system of subways or track elevation; an abundant supply of good water owned and controlled by the city.

Albany, N. Y.—A bill has been introduced in the legislature by Assemblyman Brennan authorizing an appropriation of $500,000 for a system of new state roads and the improvement of the old ones. The provisions of the bill are that the governor shall appoint three citizens of the state to act in conjunction with the superintendent of public works and the state engineer and surveyor in drawing up a plan for a system of roads throughout the state, which plan shall be used by the superintendent of public works in carrying out the purpose of the act. The work shall be carried out under the direction of the superintendent of public works, supervised by the commission provided for. For the expenses of the commission $10,000 is provided.

CONTEMPLATED WORK.

Grinnell, Ia.—The question of street paving is being considered.

Middletown, O.—Paving is proposed for Main street, from Third to Fifth.

Tiffin, O.—Paving is proposed for Main street, from Jefferson to Hedges.

Shelby, O.—Brick paving is contemplated for Main and Broadway streets.

Great Barrington, Mass.—The press suggests that Main street be macadamized.

LaCrosse, Wis.—About three blocks of Avon street will be macadamized.

Decatur, Ill.—About two miles of brick paving is proposed for this year.

Alexandria, Va.—The paving of a number of streets is proposed. E. C. Dunn, City Engineer.

Reading, Pa.—Penn and other streets will be paved with brick. E. Chamberlain, City Engineer.

Brooklyn, N. Y.—Asphalt paving is favored for Fourth avenue, from Third to Sixtieth streets.

Winnipeg, Man.—This city will lay ten miles of new macadam pavements this year.

Easthampton, Mass.—The extension of the macadam roads is recommended by Mayor Mather.

Erie, Pa.—An ordinance has been passed providing for the curbing of all unpaved streets.

Rochester, N. Y.—A Medina block pavement is contemplated for State street, from Center to Lyell avenue.

Butler, Pa.—The question of increasing the bonded indebtedness for street paving will be voted on in February.

Riverton, N. J.—The question of putting down cement sidewalks is being considered by the mayor and council.

New Brunswick, N. J.—A plan to bond Middlesex county for $250,000 for road building is favored.

Rankin, Pa.—The question of issuing $28,000 bonds for street improvements and sewers will be voted on Feb. 16.

Escanaba, Mich.—An election will be held in April on the question of issuing $175,000 in bonds for building roads.

Savannah, Ga.—Ordinances for paving Bryan and Farm streets with granite blocks were adopted by the city council Jan. 18.

Rye, N. Y.—The supervisors at White Plains have been asked to improve the roads around this village; estimated cost, $13,500.

Duquesne, Pa.—The question of issuing $65,000 in bonds, $40,000 for street improvements and $25,000 for sewers, will be voted on.

Savannah, Ga.—Granite block paving has been recommended for eight streets, according to press reports. W. J. Winn, City Engineer.

Richmond, Ind.—Brick will probably be substituted for cedar blocks for the flooring of the new Main street bridge.

Minneapolis, Minn.—F. W. Cappelen, City Engineer, has recommended that four streets be paved with asphalt and two with brick this year.

Pittsburg, Pa.—Contracts will probably be let in May for the proposed road work in this county. Fred W. Patterson, McKeesport, Pa., Road Engineer.

Easton, Pa.—Ordinances for brick paving in certain streets are being considered by councils. Councilmen Young and Buckman are interested.

Hartford, Conn.—A petition has been circulated asking that Main street, from the termination of the present asphalt pavement to Wyllys street, be paved with ashpalt.

Philadelphia, Pa.—The dangerous condition of a block of rock asphalt paving on Broad street may make it necessary to replace it with new paving.

Seymour, Ind.—A resolution was passed by the City Council Jan. 21 to pave fifteen more blocks with vitrified brick within the central part of the city.

Napoleon, O.—(Special.)—C. N. Schwab, C. E., says that the Council has passed an ordinance for paving Washington street, from Monroe street to Sheffield avenue.

Columbus, O.—A proposition is being considered by the Board of Public Works for widening and improving 3,000 feet of N. Fourth street. Felix A. Jacobs interested.

Pittston, Pa.—Ordinances have been favorably reported upon for paving Lambert street, opening Church street to Broad and widening N. Main street. P. F. Joyce, President Council.

Indianapolis, Ind.—City Engineer Jeup suggests that asphalt be substituted for gravel in the proposed improvement of Indiana avenue, from North street to the Fall Creek bridge.

Windsor, Ont.—Alderman Dixon, Chairman of the Board of Works, is of the opinion that this city cannot afford brick and asphalt pavements, but favors cedar blocks on a cement foundation.

New Haven, Conn.—The selectmen of this city and Woolbridge decided Jan. 19 to grade off the top of the Long Hill and to make a macadam road. Ex-City Engineer Hill will furnish estimates of the cost.

Madison, Wis.—City Engineer Dodge has been authorized to secure estimates of the costs of paving the streets around the Capitol with asphalt, the present macadam paving to serve as a foundation.

Davenport, Ia.—The paving committe ordered the City Engineer, Jan. 5, to make approximate estimates on paving Fifteenth, Harrison, Third, Marquette, Le Claire and other streets and alleys.

Jamaica, L. I.—A bill has been introduced in the Assembly to allow the citizens of this place to vote on the question of bonding the village for $200,000 for macadamizing the principal streets.

Montgomery, Ala.—Brick paving is proposed for portions of Madison avenue and Monroe, N. Lawrence, Montgomery and Lee streets, and granite block paving for portions of Lee and Coosa streets.

Albany, N. Y.—Brick paving is contemplated for Jefferson street between Eagle street and Delaware avenue, and Canal street, between N. Pearl and Lark streets, will be repaved with brick.

Spokane, Wash.—Press reports state that "property owners on Riverside avenue are quietly canvassing the best means of obtaining the best paving for the least money, and something more than talk is expected to come out of it."

Winona, Minn.—A committee was appointed Jan. 11, consisting of D. Sinclair, H. Choste, H. W. Lamberton and Alderman Schmitz, Kowalewski and Raymond, to further investigate the question of macadamizing and report in February.

Paterson, N. J.—The question of submitting to the voters the issuance of $100,000 in bonds every year for ten years for street improvements is being considered by the council. Aldermen Post Durgett and Wright interested.

Baltimore, Md.—The property-holders of East North avenue made a protest Jan. 17 against the proposed cobblestone for that street and endeavored to have the ordinance repealed and another prepared authorizing paving with improved pavement.

Duluth, Minn.—The towns of Tower, Va., and Hibbing are endeavoring to secure a road to the Rainy Lake district. A bill will be introduced in the Legislature appropriating $20,000 for the construction of a road from Grand Rapids to Koochiching.

Atlanta, Ga.—The residents of Washington street, between Waverly Place and Woodward avenue, have asked that the street be paved with asphalt. The property-owners on Whitehall street will petition for asphalt or brick paving from Forsyth street out to the Central railroad.

Akron, O.—East Market street, from Howard street to Case avenue, will probably be widened eight feet and paved with brick. The city commissioners are urging the passage of an ordinance, by the council, to this effect. The residents of Bowery street are anxious that it should be paved with brick.

Chicago, Ill.—The Cottage Grove Avenue Business Men's Improvement Association has elected officers as follows: President, M. M. Quinn; vice-president, E. O. Sache; secretary, M. J. Murray; treasurer, Christain See. The object of the asosciation is to secure asphalt paving and free electric light for Cottage avenue.

Quincy, Ill.—(Special.)—Dow R. Gwinn, superintendent of Quincy water works, says that ordinances will be passed for seventeen blocks of brick paving on six inches of macadam and three inches of sand, and twenty-six blocks of macadam-novaculite paving, seven inches of macadam in two courses, with a three-inch top dressing of novaculite. E. R. Chatten, City Engineer.

Niagara Falls, Ont.—(Special.)—Charles H. Mitchell, City Engineer, says that on account of the large quantities of suitable rock for road metalling, which was maintained in this vicinity during the process of sewer construction, etc., it is probable that considerable macadam and brick road improvement will be made during the coming year.

Saginaw, Mich.—The amount to be expended for street improvements will probably be limited to $75,000, in which case the paving committee will recommend that only that part of Jefferson street, between Holland and Hoyt, be paved with asphalt. North Washington, from Johnson to Potter, will be paved and perhaps Germania, between Washington and Genessee, and Johnson, between Tilden and Warren.

Albany, N. Y.—The Board of Contract and Apportionment has decided to again recommend to the common council that Lodge street, from Beaver to Pine, and Chapel street, from State to Clinton avenue, be paved with vitrified brick. However, where the grade of the street exceeds eight feet in 100 feet, the carriageway, with the exception of a strip four feet wide on each side in the gutters, be paved with dimension granite blocks, the four-feet-wide gutters being paved with brick for the benefit of wheelmen and to facilitate the drainage of surface water.

Newark, N. J.—Paving is contemplated this year for the following streets: Camden street, from Springfield avenue to Thirteenth avenue; Court street, from High street to Belmont avenue; Morton street, from High street to Belmont avenue; Montgomery street, from High street to Belmont avenue; Waverly place, from Somerset street to Belmont avenue; Waverly avenue, from Belmont avenue to Springfield avenue; Charleton street, from Springfield avenue to Avon avenue; Prince street, from Kinney street to Avon avenue; Broome street, from Kinney street to Rose street; Quitman street, from Kinney street to Clinton avenue.

CONTRACTS TO BE LET.

Bellevue, Pa.—The council authorized Jan. 19 that bids be advertised for paving Euclid avenue.

Decatur, Ind.—Bids will be received until March 4, for the Bluffton and Decatur gravel road by the County Commissioners.

South Bend, Ind.—(Special.)—William M. Whitten, City Civil Engineer, says the contract will be let Feb. 22 for 39,000 square yards of brick paving.

Madison, Ind.—Sealed bids will be recived until March 2, for building the Hatcher Hill, Paper Mill and Shun Pike gravel roads. Gam. S. Taylor, County Auditor.

Omaha, Neb.—The Board of Public Works has instructed Chairman Monroe to advertise for bids for repairing S. Sixteenth street, from Pierce to Vinton, with sheet asphaltum.

Denver, Col.—Mayor McMurray signed the Capitol Hill grading and curbing bill with the understanding that bids would not be advertised until Feb. 1, nor opened until Feb. 15.

Glens Falls, N. Y.—Bids are invited until Feb. 9, for the erection of a trestle sidewalk, 170 feet long, supported by columns, across the gulf at the south end of the river. A. Reidy, President.

Scranton, Pa.—A resolution authorizing the City Clerk to readvertise for bids for paving Mulberry street, between Mifflin and Webster avenues, has been signed by Mayor Bailey. Competition will be admitted on all kinds of asphalt.

Wilmette, Ill.—Sealed proposals will be received until Feb. 2, for macadamizing and otherwise improving Central and Wilmette avenues and Hill street; certified check, $1.000. E. P. Fatch, Village Clerk, 140 Dearborn street, Chicago, Ill.

Hamilton, O.—(Special.)—L. A. Dillon, City Engineer, says bids will be received until Feb. 16, for about 18,000 square yards of sheet asphalt, block asphalt and vitrified brick paving, the material to be determined upon after the bids are received. M. O. Burns, City Clerk.

Swayzee, Ind.—The Commissioners of Grant county have decided to ask for bids for constructing the Taylor creek gravel road, running from the Converse Brick Works to this place. The original petition for this work was filed in 1892, but the matter has been delayed by litigation ever since until Judge Custer recently reduced the assessment.

Dixon, Ill.—(Special.)—Sealed proposals will be received until Feb. 10, for grading, curbing, paving and sewering portions of First street, Galena, Hennepin and Peoria avenues. Approximate quantities: Grading, 2,700 cubic yards; stone curbing, 2,700 lineal feet; brick curbing, 300 lineal feet; brick paving, 6,000 square yards; sewers, 300 lineal feet of twelve-inch. E. W. Smith, City Clerk.

Cleveland, O.—Sealed proposals will be received as follows: Until Feb. 3, for grading, draining, flagging, paving with old Medina stone redressed and improving sundry streets; until Feb. 17, for grading, draining, curbing and paving with brick, Alanson, LaGrange, Van Buren and Webster streets, and Seelze and Waverly avenues. D. E. Wright, Director Public Works.

CONTRACTS AWARDED.

Kansas City, Mo.—The contract for macadamizing part of the Spring Branch road was awarded Dec. 31 to Colyer Bros.

Toledo, O.—Bids were received Jan. 11 for paving Huron street, between Washington and Lafayette. The only bid for asphalt was presented by William McMahon, while Thomas McKinney was the lowest bidder on brick.

Jersey City, N. J.—The contract for paving Glenwood avenue with asphalt, bids for which were received Oct. 12, 1896, was awarded Jan. 4 to the California Asphalt Company at $2.13 a square yard. The other bids received for this contract were: Barber Asphalt Paving Company, $2.55 a square yard; Standard Asphalt Company, $2.38 a square yard.

Woodbury, N. J.—Bids were received Jan. 20 for the proposed stone road from Westville to Glassboro. The bids, which are for telford and macadam, ten inches deep, are as follows: Johnson & Wickersham, Media, Pa., telford, 93½ cents a square yard; macadam, 92½ cents. B. M. and J. F. Stanley, Philadelphia, telford, 81 cents; macadam, 79 cents. Barbour & Ireland, Philadelphia, telford, 93 cents; macadam, 90 cents. Keihn & Allen, Trenton, telford, 80 cents; macadam, 84 cents.

Lima, O.—(Special.)—L. F. Prevost, City Engineer, says that bids were received Jan. 12 for paving W. Spring street, from S. Main to Jameson avenue, 22,331 square yards, with asphalt, as follows: Gilson Asphaltum Company, St. Louis, Mo., with "Gilsonite," $61,108.06; F. E. Cole, Toledo, O., standard Trinidad land asphalt $52,790.28; Barber Asphalt Paving Company, Trinidad Pitch Lake asphalt, $48,679.08; E. M. Ayres, Zanesville, O., Wasatch Lime Rock and California asphalt, $40,734.07. The contract was awarded to E. M. Ayres.

St. Louis, Mo.—Contracts for street improvements were awarded Jan. 15 by the Board of Public Improvements, as follows: Hill-O'Meara Construction Company, granite block paving, alley in block No. 174, $1,236; No. 276, $1,210.25; No. 503, $1,261.75; No. 516, $1,261.75; No. 905, $1,390.50. H. Reuckling & Co., granite blocks, alley in block No. 896, $1,525; No. 901, $1,535; Mallinckrodt street, $5,795. Heman Construction Company, telford paving, Bell avenue, between Marcus and Walton avenues, $2,518.35. J. E. Perkinson, telford paving, Lincoln avenue, between Prairie and Vandewater avenues, $3,027.69.

Chattanooga, Tenn.—Bids for furnishing this city with curbing, granite blocks and brick for gutters for West Seventh street,

between Pine and Cypress, were received Jan. 5. The bids for curbing are for straight and circular, respectively, and are as follows: Curbing—J. H. Bragg, 33 and 63 cents; John Bennett, 28 and 60 cents; Fred Leiker, 35 and 60 cents; L. Lawson, 33 and 53 cents; George L. Gillespie, 30 and 75 cents; J. F. Bryan, 37 and 60 cents. Granite blocks—W. E. Smith, $131.75; George L. Gillespie, $98; J. F. Bryan, $113.75. Brick—H. C. Powell, $5.50 per 1,000; J. F. Bryan, $6.50 per 1,000. Gutters, building as a whole—George L. Gillespie, 32 cents a lineal foot; J. F. Bryan, 45 cents a lineal foot.

Athens, Pa.—Bids were received Jan. 1 for 6,600 square yards brick paving, filled with Portland cement grout, with asphalt extension points, and 3,000 lineal feet of 5x20 inches curb as follows. Costello & Neagle, excavation, 2,700 cubic yards, 25 cents; paving, $1.55 to $1.80 a square yard; curbing, Pennsylvania blue stone, 46 cents and Medina stone, 52 cents a lineal foot. Jamestown Construction Company, excavation, 30 cents; paving, $1.48 to $1.82; curbing, 44 and 58 cents. J. Henry Clark, excavation, 22 cents; paving, $1.69 to $2.10; curbing, 35 and 59 cents. James McCloud & Co., excavation, 24 cents; paving, $1.53 to $1.84; curbing, 50 to 52 cents. G. H. Stimson, excavation, 24 cents; paving, $1.63 to $1.92½; curbing, 48½ and 67 cents. E. A. Post, excavation, 35 cents; paving, $1.56 to $1.85; curbing, 46½ and 60 cents. J. Henry Clark bid 14 cents extra lineal foot for paving along the street railway tracks and James McCloud & Co. 40 cents extra a square yard for paving along the street railway tracks.

SEWERS.

Newark, N. J.—The Passaic Valley Sewerage Commission will place their report before the legislature by Feb. 15.

Sacramento, Cal.—Assemblyman Ennis has a bill before the Legislature for the construction of a sewage plant at the Folsom Prison.

Rock Island, Ill.—The city council rejected the storm drain, built at a cost of $20,000, owing to the use of an alleged inferior quality of cement.

Chicago, Ill.—The report of the commission appointed to prepare plans for a system of intercepting sewers to keep the sewage out of the lake, is about completed. The experts composing the commission have disagreed upon many points, the most important of which is said to be the size of the proposed sewers.

Columbus, O.—The citizens have asked that the West Side sewer be made useful. Director Bargar is of the opinion that it will cost $250,000 to find an outlet for the sewer and the experiment would then be doubtful. This is the sewer the contractors for which were given a verdict for $40,000 by a board of arbitrators.

According to Mexican papers American manufacturers will have a great opportunity for securing the remaining contracts for the sewerage and drainage system of the city of Mexico, due principally to the time that can be saved in quick delivery. The Board of Sanitation in Mexico has appropriated about $3,000,000 to carry on the work of draining the city.

Fairhaven, Mass.—A petition has been prepared to present to the Legislature this year for authority to issue bonds to the amount of $75,000, payable at a time not to exceed 20 years, at a rate of interest not to exceed 5 per cent. When the sewer system in this place was decided on a special act was secured from the Legislature authorizing the issue of bonds, notes or scrip by the town to an amount not exceeding $80,000. Under the provisions of the act notes of the town, payable in six months, were issued to the amount of $74,500. These notes have since been renewed, but the selectmen have found that under the act they have not authority to refund the debt contracted on account of sewer construction. Hence the above petition.

CONTEMPLATED WORK.

SEWERS—CONTEMPLATED WORK.

Bennington, Vt.—Sewer bonds will be issued by the village trustees.

Kalamazoo, Mich.—Sewers are contemplated on Wall and E. Walnut streets.

Butler, Pa.—The question of sewer extension will be voted on in February.

Millburn, Mass.—The sewerage question will be decided about March 14.

Denver, Col.—Preliminary details are being made for a system of storm sewers.

Mount Vernon, N. Y.—The question of sewage disposal is again being agitated. S. D. Odell, City Engineer.

Ann Arbor, Mich.—A sewer is contemplated for the Ann street sewer district. George F. Key, City Engineer.

Santa Cruz, Cal.—Petitions have been presented to the council for sewers in a number of streets.

Williamsport, Pa.—The mayor has recommended that $7,150 be expended in sewer construction.

Hoboken, N. J.—The common council floated $92,000 worth of the main outlet sewer bonds Jan. 14.

Michigan City, Ind.—Specifications have been submitted for about 2,700 feet of 18-inch tile sewer.

Boston, Mass.—An appropriation of $20,000 has been asked for to build storm sewers in the section of Ashmont.

Rankin, Pa.—The question of issuing $26,000 in bonds for sewers and street improvements will be voted on Feb. 16.

Monterey, Cal.—Plans and specifications will be prepared for sewers in two streets by L. G. Hare, City Engineer.

Stamford, Conn.—Plans have been prepared for a sewerage system for West Stamford by H. G. Schofield of Bridgeport.

Woonsocket, R. I.—The extension of certain intercepting and trunk sewers has been recommended. F. H. Mills, City Engineer.

Decatur, Ill.—Plans have been completed for a sewerage system; estimated cost, $80,000. Sullivan Burgess, City Engineer.

Akron, O.—Profiles for a twenty-inch sewer two miles long in the Little Cuyahoga valley will be made by S. W. Parshall, City Engineer.

Rochester, N. Y.—Plans have been prepared for lowering the sewers and water pipes at the Erie canal. E. A. Fisher, City Engineer.

Marysville, Cal.—The City Council has taken up the sewerage question and it is hoped that a complete system will soon be begun.

East Cleveland, O.—Martin Dodge may be addressed regarding the proposed construction of a sewer at an estimated cost of $100,000.

Delhi, N. Y.—Plans for a sewerage system are being made by John W. Burke of New York City. C. E. Hill, President Board Sewer Commissioners.

Albany, N. Y.—State Engineer and Surveyor Adams has approved plans for new sewerage systems at New Hartford, Depew and Jamaica, L. I.

Media, Pa.—Plans and specifications for a sewerage system will be presented to the Council in February. Henry Howard, Chairman Sewer Committee.

Quincy, Mass.—The commission has asked the council to appropriate $160,000 more for the continuation of the construction of the sewerage system.

Evanston, Ill.—Mayor Dyche has suggested that preliminary steps be taken at once toward finding some new plan for the disposal of sewage.

Clyde, O.—(Special.)—W. E. Gillett, Clerk, says the Council has adopted a resolution to sewer Suckers Run creek. The sewer willl be twenty-four-inch pipe.

Yankton, S. D.—A petition will be sent to the Legislature for a sewer, five miles in length, from the insane hospital to the Missouri river.

Cedar Rapids, Ia.—The Board of Public Works has been instructed to prepare preliminary plans and estimates for a storm sewer in S. Eighth street.

Newark, N. J.—Plans were approved for the Emmett street sewer, Jan. 20. A resolution was passed Jan. 21 for a twelve-inch pipe sewer on Fairmount avenue.

Erie, Pa.—Ordinances have been passed providing for the construction of a sewer in Park avenue, South, German, Holland, Twenty-seventh and Liberty streets.

Hamilton, O.—The Board of Sewer Commissioners met Jan. 19 and received the report of the City Engineer in regard to plans for the Crawford's Run sewer.

Montclair, Col.—Part of the expense of the proposed sewer system will be borne by Denver. Work will begin about May 1. T. J. Milner, Chief Engineer Board of Public Works.

Sioux Falls, S. D.—The council has voted to construct a sewer on First avenue and Eleventh street at an estimated cost of $3,000 to give work to the unemployed.

Indianapolis, Ind.—If the plans that are now being considered are carried out in sewering Pogue's Run the cost will be more than $500,000, and perhaps as much as $750,000.

Woodbury, N. J.—The question of a sewerage system was discussed at a meeting of the city council Jan. 15. The estimated cost of a satisfactory system is placed at $41,000.

Terre Haute, Ind.—Samuel M. Gray, C. E., Providence, R. I., has been employed to investigate the plans for a belt sewer pre-

Cincinnati, O.—City Engineer Stanley was directed Jan. 12 to prepare a resolution for the construction of sewers in Nassau street, from the end of the existing sewer to St. James avenue; St. James avenue, from Nassau to Francisco street; Francisco street, from St. James avenue to Fulton avenue; Chase avenue, from Apple to Gordon street.

pared by John A. Cole, C. E., of Chicago.

Huntsville, Ala.—The Chamber of Commerce appointed a committee Jan. 14 to wait upon the city council and urge the immediate issuance of bonds for the construction of a sewerage system.

San Francisco, Cal.—One of the principal improvements that will be considered by the Merchants' Association will be the best method of securing an improved system of sewerage for this city.

Youngstown, O.—An investigation of the sewerage system shows that, while not adequate, it will probably not be necessary to tear it out and reconstruct completely as was at first thought.

Temple, Tex.—The Temple Sewer company has appointed a committee to secure estimates for the construction of a 24-inch pipe outlet sewer. Address Capt. H. M. Thompson, P. L. Downs and R. L. Hollingsworth.

Newton, Mass.—The question of extending the sewerage system to the Upper and Lower Falls is being considered. A pumping station would be required; also about one mile of rock excavation. H. D. Woods, City Engineer.

Crawfordsville, Ind.—The City Council has voted to put in a system of sanitary sewerage and work will begin at once. John W. Alvord of Alvord & Shields, the Rookery, Chicago, made the plans and specifications.

Salem, Mass.—Press reports state that a report has been submitted to the State Board of Health recommending the construction of a trunk sewer from this city to the sea, also a pumping station; estimated cost, $440,116.

The construction of sewerage systems is contemplated at the following places: Pembroke, Ont., and Santa Rosa, Cal. Address H. H. Harding, Denver, Col.; Lambertville, N. J., A. R. Fillebrown, City Engineer, Southbridge, Mass.

Los Angeles, Cal.—The property-owners on Carondelet and Coronado streets have filed a petition with the council asking for a sewer district to be created between Seventh and Eighth and Park and Rampart streets.

Kansas City, Mo.—Sewers will be constructed in sewer district No. 159 as follows: About 2,175 feet of 36 to 26-inch brick and 12,000 feet of 24 to 8-inch pipe sewers, 57 manholes and 37 catch basins. H. A. Wise, City Engineer.

Jamestown, N. Y.—The council has asked the mayor, reports state, to ask for bids for plans and estimates for sewage disposal works and for extending the sewers two miles to Cassadaya creek. John E. Conway, chairman Board Public Works.

Scranton, Pa.—An ordinance is in the council which provides for a main sewer in three wards, the Twelfth, First and part of the Twentieth ward. Efforts will be made to construct sewers in the South Hyde Park sewer district this year.

Colorado Springs, Col.—Mayor J. C. Plumb of this city, Mayor H. C. Frownie of Manitou and Mayor H. L. D. Morse of Colorado City have been appointed a joint committee to take under consideration the advisability of adopting a union sewerage system for the three places. A competent engineer will be employed to make plans.

Jamaica, L. I.—The Board of Sewer Commissioners has appointed John Bogart as consulting engineer to examine the plans of the proposed new system, and upon their approval they will be adopted and measures taken to secure an appropriation.

Topeka, Kas.—According to press reports plans are being prepared for sewers in Ironville and Manhattan. Plans have been prepared for 10 miles of sewers in Auburndale. A main sewer will be built in Jefferson street at a cost of $25,000. William H. Barnes, City Engineer.

Waterbury, Conn.—Judge Cowell has introduced a resolution in the Legislature, according to report, for the appointment by the governor of a commission of five to consider the whole matter of sewage disposal, and in connection therewith reviews the troubles experienced by Danbury, Waterbury and other cities.

Bloomington, Ill.—Estimates for sewers in Sugar Creek Valley, and the portion of the city north of Division street, are placed at $15,000. The state will bear part of the expense, as the sewer will be used by the town of Normal, where a number of large state institutions are located. W. P. Butler, City Engineer.

Utica, N. Y.—(Special.)—A. M. Scripture, Associate M. Am. Soc. C. E., says the New York State Board of Health has approved plans which he prepared for a complete system of sewerage, including disposal works for New Hartford, N. Y. The plans provide for approximately four and one-half miles of pipe sewers of sizes from six to twelve inches in diameter, thirty-nine manholes, ten flush tanks and about four hundred Y branches; estimated cost, $20,000 to $22,000, including disposal works.

Washington, D. C.—Albert M. Read, chairman of the committee of sewerage, recommends that the Board of Trade use its utmost endeavor to have passed during the coming session of Congress a bill authorizing the issue of low-rate interest bonds in the amount required for the construction of the system of sewage disposal recommended by the Board of Sanitary Engineers and for building the necessary trunk sewers in the District of Columbia.

Jersey City, N. J.—The Chancery Court has determined that the responsibility for the maintenance of the Ravine Road sewer as a nuisance shall be fixed upon the city. Accordingly, plans have been prepared for its proper drainage, which provide for two new sewers to connect with the main sewer in the Ravine Road to converge at Fifteenth and Monmouth streets like a Y and empty into the North river. From Palisade avenue down the hill, where the strain is greatest, the sewer will be of steel and four feet in diameter. Additional legislation will be required to carry out the plans. The cost will be assessed on the city and the property benefited.

CONTRACTS TO BE LET.

Mishawaka, Ind.—(Special.)—The contract will be let Feb. 16 for 8,000 feet of pipe sewer, and 1,200 feet of brick sewer. William M. Whitten, South Bend, Engineer.

Toledo, O.—Sealed proposals will be received until Feb. 8 for constructing a cylindrical brick sewer in Jefferson street; deposit, $700. Lem P. Harris, City Clerk.

Terre Haute, Ind.—Sealed proposals will be received until Feb. 2 for the construction of a pipe sewer in Fourth street with necessary manholes, catch basins, etc. Charles H. Goodwin, City Clerk.

Cleveland, O.—Sealed proposals will be received until Feb. 2 for the construction of sewers in six streets; certified check, $300. Bids will be received until Feb. 4 for the construction of sewers in Czar, Duane and State streets and Lussenden and Rhodes avenues; certified check, $300. Bids will be received until Feb. 18 for sewers, with outlets, in Cumberland and Quebec streets and Erie court; certified check, $700. D. E. Wright, Director Public Works.

CONTRACTS AWARDED.

Springfield, Mo.—Cooper Bros., city, secured the contract for 2,475 feet of eight-inch pipe sewer.

Houston, Tex.—R. C. Storrie was awarded the contract Jan. 5 for constructing a sewer on Heiner street for $2,702.

Buffalo, N. Y.—The Donnelly Contracting Company will probably be awarded the contract for building a new sewer in Erie canal, at their bid of $4,500.

Auburn, N. Y.—The contract for constructing sewers in Fitch and Hardenborgh avenues and Garrow and Division streets was awarded to S. Adams & Son Jan. 9.

Springfield, O.—The lowest bids received Jan. 11 for constructing pipe sewers were presented by Pat Caffrey, city, as follows: Alley east of Water street, $2,383; Nelson and Farlow streets, $2,966.

Sandusky, O.—Bids were received Jan. 9 for constructing a sewer in Monroe street as follows: M. J. Callan, $6,925; Reuter & Scheiber, $7,561; Frank Henry, $7,605; Michael McKean, $7,938; A. G. O'Donnell, $8,008; John Duffy of Canton, $9,185.

York, Pa.—The York Sewerage Company has applied to the council for a franchise to construct and operate a sewerage system, which, after thirty years the city will have the right to purchase. The mayor has recommended the acceptance of the franchise under certain conditions.

Rochester, N. Y.—The contract for the Griffith street outlet sewer was reawarded Jan. 11 to Whitmore, Rauber & Vicinus for $5,416.65. The contract was originally let to Crahan & Kearns for $4,607, who asked to be relieved from the contract on the ground that it would be impossible to complete the sewer within the time specified by the Sewer Commissioners.

St. Louis, Mo.—The contract for reconstructing the Mill Creek sewer at Fourteenth and Gratiot streets was awarded Jan. 13 to the St. Louis Quarry Construction Company for $17,988.50. For the construction of Potomac street sewer, district No. 8, James Martin was the lowest bidder at $3,346.74. An amendment has been drafted to be inserted in the Mill Creek sewer bill, to increase the present appropriation bill from $16,000 to $30,000.

WATER-WORKS.

WATER WORKS.

Philadelphia, Pa.—The Finance Committee of Councils postponed, Jan. 20, consideration of the $300,000 appropriation for experimental filter plants.

Topeka, Kas.—A suit has been filed in the Supreme Court by the city to forfeit the franchise of the Topeka Water Company, whose indebtedness is more than $1,000,000.

Cannelton, Ind.—The water works was sold Jan. 14 for $6,000 to satisfy a judgment held by the Union Trust Company of Philadelphia. W. B. Thomas and Charles Reifsneider of Westminster, Md.; Capt. John Egermann and M. A. Eberhard of Troy, Ind., were the purchasers.

Duluth, Minn.—The order appointing a receiver for the Duluth Gas & Water Company was rescinded Jan. 11 by Judge Lochren of the United States Circuit Court. The water works case was settled by a decision made by Judge Mitchell of the Supreme Court Jan. 19, which is in favor of building a plant.

New Albany, Ind.—A bill has been introduced at Indianapolis to enable this city to issue bonds equal to the appraised value of the water works, for their purchase, the bonds to be secured by a conveyance of the property to the trustees to be held in trust for the payment of the bonds. The bonds are not to be construed as an indebtedness of the city, but are to constitute a lien on the property.

Pittsburg, Pa.—The Filtration Commission has asked for $15,000 additional in order to enable it to employ an expert and conduct exhaustive water purification experiments. The commission originally had $10,000 at its disposal, all of which has not been expended. Mechanical filtration is favorably regarded by the commission. The report is signed by Robert Pitcairn, S. D. Warmcastle, H. P. Ford, W. J. Holland, James M. Bailey, J. Guy McCandless, J. R. Vincent, William McConway, Edward M. Bigelow, William Flinn and G. L. Holliday.

Washington, D. C.—Andrew Rosewater, C. E., of Omaha, Neb., has written to the commissioner of Indian affairs calling attention to the fact that the proposed filters for the Pine Ridge and Rosebud Agencies, in South Dakota, will be altogether too small to cleanse the amount of water which will be required, and that unless an amendment is made to the specifications the government will eventually be a heavy loser. The commissioner has written to the agents at Pine Ridge and Rosebud to make an investigation and report the condition of affairs. In the meantime no contracts will be awarded.

St. Louis, Mo.—A proposed charter revision provides that this city shall not sell or lease its water works plant, except pursuant to an ordinance unanimously recommended by the Board of Public Improvements, passed by a seven-eighths vote of the Municipal Assembly and ratified by a five-sixths vote of the people. It is claimed that a scheme to sell the water works has been unearthed, which caused the Charter Revision Commission to insert among the proposed amendments one which declares that the water works shall never be sold, excepting with the consent of the voters of the city as expressed at an election.

Albany, N. Y.—Senator Brush has introduced a bill in the senate proposing a State Water Commission for New York. The bill provides that the Governor shall appoint three persons, two of them residents of greater New York, who, with the State Engineer and Secretary of the State Board of Health, shall form a board and investigate the whole general subject of water supply for the cities of the State and the feasibility of State canstruction or reservoirs and conduits for the supply of water to cities and towns. The board is to include in its investigation the Adirondack region, Lakes George, Champlain, Ontario and Erie. The board is authorized to employ engineers and other assistants and to expend $25,000.

CONTEMPLATED WORK.

Winchester, Mass.—An appropriation will probably be made in March for water works.

Hastings, Neb.—It is proposed to reconstruct the pumping plant. G. J. Evans, Mayor.

Franklin, Minn.—This town has again voted for water works. Peter E. Wicken, Recorder.

Runge, Tex.—A stock company may be organized to put in a complete system of water works.

Coshocton, O.—A new pumping engine may be purchased in the spring. D. A. Raiff, Superintendent.

Menasha, Wis.—A franchise will be granted for constructing water works. P. V. Lawson, Mayor.

Baltimore, Md.—Dr. McShane, Health Commissioner, will recommend the establishment of a filtration plant.

Los Angeles, Cal.—Preliminary steps were taken by the city council Jan. 18 toward securing a water system owned by the city.

Philadelphia, Pa.—An ordinance authorizing the laying of water mains in about 25 streets has been approved by Mayor Warwick.

Franklin, Pa.—A new pump and about two miles of 12-10-inch pipe may be purchased in the spring. John L. Hanna, Jr., Superintendent.

Bozeman, Mont.—This city will vote on the purchase of the water works system and the extension of the water mains.

Atlanta, Ga.—An appropriation of $100,000 for new pipe and $12,000 for laying it has been recommended. Cephas M. Brown, Secretary Water Board.

Hastings, Pa.—The purchase of the water works system is contemplated by the borough, also laying a new 8-inch main and enlarging the reservoir.

Buffalo, N. Y.—The purchase of a 30,000,000 gallon pumping engine is recommended for the water works plant by Mayor Jewett in his annual message.

The water works question will be voted on as follows: Westerville, O.; Excelsior, Minn.; McGregor, Ia.; Centerville, Mich.; Fox Lake, Wis.; Slater, Mo.

Escanaba, Mich.—A bill has been introduced in the Legislature asking for authority for this city to borrow $125,000 for a water works system.

Martinsburg, W. Va.—The purchase of another set of pumps, of 2,500,000 gallons capacity, is contemplated this spring. J. M. Shaffer, Superintendent.

Hoboken, N. J.—The Hoboken Board of Water Commissioners adopted a resolution Jan. 5, directing the committee on supplies and the committee on finance to prepare specifications, first for an independent water plant, and second for a supply of water to be delivered at the city mains.

Oceanide, Cal.—The trustees have appropriated $600 for the employment of an engineer to investigate the most available water supply.

St. Louis, Mo.—The little town of Ferguson will be provided with an unlimited supply of water, drawn from the St. Louis city mains, within a very short time.

Oregon, Mo.—The Council is having plans and specifications printed for a system of water works, and will try to sell the $25,000 worth of bonds in February.

Ogdensburg, N. Y.—The purchase of two pumps, one steam and one power, is contemplated this spring; some extension of water mains will be made, also. H. A. Lord, Superintendent.

The question of water works is being agitated at the following place: Winchester, Ill.; Delaware, Minn.; Jerome, Ariz.; Bourbon, Ind., Edward Brillhart, President Board Trustees.

Horseheads, N. Y.—The question of granting a franchise for water works or issuing bonds and constructing a gravity system will be voted on in February. R. G. Eisenhart, President Trustees.

Winona, Minn.—Fred H. Pickles, C. E., of this city, has been engaged to prepare plans and superintend the construction of a water works system at Adams, a small town near Spring Valley, Minn.

Tupper Lake, N. Y.—This place is to have a system of water works. A Citizens' Committee has chosen for officers the following: President, E. G. Reynolds; vice-president, D. J. A. Thissell; treasurer, C. H. Sisson; secretary, C. L. King.

Elkhart, Ind.—The Water Works Company contemplates putting in new engines in the spring. Elliott Cruell and E. Pounder visited Marion and Indianapolis Jan. 20 to examine the engines used in the water works at these places.

Des Moines, Ia.—A resolution was passed by the Council Jan. 4 authorizing the Board of Public Works and the City Engineer to employ a competent hydraulic engineer to assist in the preparation of plans and specifications for a system of water works.

Norwood, O.—The Water Works Trustees are alarmed about the condition of the pumps at the East Norwood station, which are wearing out. Efforts will be made to have the Council indorse the sale of bonds so that new pumps can be put in at once.

Water mains extension are contemplated at the following places: Gallipolis, O., 3,000 feet; Forreston, Ill., H. H. Freasman, Superintendent; Ottumwa, Ia., W. W. Co.; Ocheyedan, Ia., Frackville, Pa., F. S. Haupt, General Manager; Sullivan, Ind., J. W. Joplin, Superintendent; Mendon, Ill., S. H. Bradley, Village Clerk; Amherst, Mass., Amherst Water Company; Savannah, Ga.; Indianapolis, Ind., F. A. W. Davis, Vice-President.

Water works systems are contemplated at the following places: Good Hope, Ill.; Billett, Col., Town Council; Washington, Cal., Hugo Frommelt interested; Monroe, Ga.; Arcade, N. Y., G. M. Cowan, Engineer; Leipsic, O., G. C. Shiffler, Town Clerk; Lima, N. Y., F. A. Strosenburg, Mayor; Honma, La., J. C. Dupont, Mayor; Lancaster, S. C., Darcy C. Thompson, Superintendent; Pocahontas, Va.; North Wilkesboro, N. C., J. R. Coffey, Mayor; Fitzgerald, Ga.; Mt. Gilead, O.; Omer, Mich.; Sidney, Ia.; Westport, Mo., H. B. Abercrombie, Water Commissioner; Flagstaff, Ariz., F. W. Smith, Town Clerk; Savina, N. Y., T. C. Wall, Clerk; Takoma Park, D. C.; Darby, Pa., J. F. Welby, Clerk.

CONTRACTS TO BE LET.

Bentonville, Ark.—Bids will be invited soon for the proposed water works system. J. D. Corey, Secretary Board.

St. Louis, Mo.—Bids will be received until Feb. 16 for the new pumping engines for the water works department at the Chain of Rocks.

Bradford, Pa.—Bids will probably be received in March for 22,750 feet of 6-inch and 2,290 feet of 4-inch pipe, 48 hydrants and 57 gates. S. D. Heffner, Superintendent.

North Tonawanda, N. Y.—Bids are asked until Feb. 8 for furnishing and erecting a 6,000,000 gallon pumping engine. Certified check, $2,500. S. C. Woodruff, Superintendent.

Perth Amboy, N. J.—Bids will be received until Feb. 8 for constructing and erecting one 4,000,000 gallon pumping engine, with foundation. George W. Eggers, Superintendent.

DeRuyter, N. Y.—Bids will probably be asked early in February for material and construction of a water works system. E. N. Coon, Secretary Water Commissioners.

Port Gibson, Miss.—(Special.)—Sealed bids will be received until Feb. 15 for the whole, or in part, for a system of water works, including artesian well and standpipe. Thomas M. Rea, City Clerk.

St. Louis, Mo.—Bids will be received until Feb. 5 for furnishing and erecting two 30-inch and four 36-inch erection valves and two 30-inch and two 36-inch delivery valves. Board Public Improvements.

Westpoint, Miss.—The plans and specifications for a water works system will be ready to submit to bidders about Feb. 15. Walter G. Kirkpatrick, City Engineer, of Nashville, is preparing the plans and will superintend the construction.

Hawkinsville, Ga.—Sealed proposals will be received until Feb. 17 for constructing a system of water works and furnishing material for same. Bids will be received until Feb. 17 for installing and erecting an electric light plant. S. A. Way, Mayor.

Cleveland, O.—Sealed proposals will be received until Feb. 6 for furnishing and delivering 3,000 cast iron stop cock boxes. Certified check, $1,000. Also for furnishing such water gates as may be required during the year 1897. Certified check, $500. D. E. Wright, Director Public Works.

CONTRACTS AWARDED.

Jefferson, Ia.—A new pump has been purchased of the Dean Steam Pump Company.

Whiting, Ind.—A franchise to erect water works has been applied for by George M. Storey.

Mt. Morris, Ill.—The contract for extending the water mains has been awarded to Price & Buser of this place.

Fort Madison, Ia.—The contract for building a receiving basin 25x40 feet, holding 1,500,000 gallons of water, has been awarded to B. Lantry & Sons. The work will be completed by March 15.

Waupaca, Wis.—A franchise has been granted to Baldwin & Hansen for the construction of a water works system for about $50,000.

Rockville, Md.—The contract was awarded Jan. 20 to Rosser & Castoe of Bellaire, O., for constructing the water works system for $16,888.

Brooklyn, N. Y.—Charles Hart secured the contract for the construction of the 36-inch cast iron pipe line from Hempstead Storage Reservoir to Smith's Pond for $92,379.

Chicago, Ill.—The Henry R. Worthington company of New York was awarded the contract Jan. 23 for six large pumping engines, three for the Lake View station and three for the new Northwest water tunnel.

Momence, Ill.—Bids for a system of water works have been received as follows: A. W. Gates, Earlsville, Ill., $19,199.46; H. A. Boedker, Chicago, $23,000; Ruddy Contracting Company, Chicago Ill., $18,840.48; D. T. Thacher, Chicago, $17,825.

Abbeville, S. C.—The water works contract has been awarded as follows: Pipes, Chattanooga Pipe Company, $11,213.99; standpipe, Charles Rosser, Bellaire, O., $3,450; hydrants and valves, Rensselaer Manufacturing Company, Troy, N. Y., $1,575.31; trenching and pipe laying, Penyman & Kelly, Asheville, N. C., $3,158.59; artesian well, Southern Water Company, Atlanta, Ga.

BRIDGES.

Ponchatoula, La.—A contract will be let March 1 for a steel bridge over the Tangipahoa river.

Herkimer, N. Y.—The Town Board has decided to build a bridge across the hydraulic canal at Albany street.

Harrisburg, Pa.—The construction of bridges has been recommended over Armstrong and Deep creeks.

Grinnell, Ia.—Bids will be received until Feb. 3 for bridge building for the ensuing year. County Auditor.

Burlington, Vt.—A bridge is being agitated to cross the Delaware river, connecting this town with Bristol.

Chattanooga, Tenn.—A new bridge is contemplated over Sale creek, on the Washington road. Commissioners Beene and Wallace.

Karnes City, Tex.—New bids will be asked for building two steel bridges by the Commissioners' Court.

Brownsville, N. Y.—A bridge will be built across the Black river between this town and Hounsfield; estimated cost, $3,300.

Hamilton, O.—County Engineer Weaver has been directed to prepare plans for an iron bridge over the Hydraulic canal at Block street.

Oakland, Cal.—Supervisors Church and Talcott have been appointed a committee to secure plans for a bridge at Webster avenue.

Jersey City, N. J.—An iron bridge over the canal at Pacific avenue is proposed. Jeremiah Zumbusch, Chairman South Bridge Committee.

Bridgeport, O.—The Wrought Iron Bridge Company, Canton, O., has been awarded the contract for a new superstructure for the bridge over Wheeling Creek.

Albany, N. Y.—Assemblyman George W. Wilson introduced a bill Jan. 18, providing for the building of two draw bridges between New York and Brooklyn.

Marietta, O.—An ordinance granting a franchise for the proposed Ohio river railroad and highway bridge was introduced in the City Council, Jan. 5.

Sac City, Ia.—Bids will be received until Feb. 24 for the construction of all iron and wooden bridges for the year 1897; bond, $1,000. County Auditor.

Atlanta, Ga.—The Board of Aldermen authorized advertising for bids for a new steel bridge over Bell street Jan. 22. R. M. Clayton, City Engineer.

York, Pa.—Sealed bids will be received until Feb. 15 for all bridges to be built during the remainder of the year 1897. J. D. White, County Clerk.

Indianapolis, Ind.—A petition has been filed for opening Oriental street, from Ohio to Michigan, and building a bridge at Pogue's Run at Oriental street.

Fernandina, Fla.—Sealed bids will be received until Feb. 13 for an iron bridge across Amelia river; check, $100. W. D. Ballentine, Chairman Board of County Commissioners.

Niagara Falls, N. Y.—The Board of Public Works has recommended the construction of overhead bridges at Ferry and Walnut streets. W. W. Reed, City Engineer.

Johnson City, Tenn.—A new bridge across the Nola Chuckey river, near Emberville, has been decided upon by the county court. E. A. Shipley, Chairman Committee.

Milwaukee, Wis.—Bids will be received until Feb. 4 for furnishing and constructing the iron and steel work for two bridges in Lake Park. Charles K. Lush, Secretary Board of Park Commissioners.

Philadelphia, Pa.—The highway committee has reported favorably on a bill authorizing the construction of a bridge at Rhaun street to abolish the grade crossing there.

Cedar Creek, Neb.—Plans are wanted for a bridge across the river, to be 1,400 feet long and twelve feet wide; estimated cost, $4,000. Henry A. Schneider, Secretary Bridge Company.

Red Cliff, Col.—Permission has been asked of the legislature to grant Eagle county permission to build an iron bridge over the Grand river, at Dotsero; estimated cost, $12,000.

Long Island City, N. Y.—The Wrought Iron Bridge Company, Canton, O., secured the contract for building a new steel bridge over the tracks of the Long Island railroad in this city for $4,650.

York, Pa.—The Wrought Iron Bridge Company at Canton, O., was awarded the contract for building a new steel bridge and viaduct over the tracks of the Pennsylvania Railroad Company, at College avenue, for $43,600.

Syracuse, N. Y.—A bill has been introduced at Albany, providing for the erection of a bridge over Onondaga creek at Seymour street, at a cost of $12,000, and one at Temple street, at a cost of $10,000.

Ware, Mass.—The selectmen of Ewing and Montague presented plans, Jan. 6, for the new iron bridge to be built across Miller's river at Miller's Falls. The plans have been referred to Engineer Davis of Northampton.

Catawissa, Pa.—The viewers have recommended the construction of a wrought iron bridge across the Susquehanna river, to replace the one destroyed in September. J. Murray Africa, Huntingdon, Pa., Chairman Viewers.

Spokane, Wash.—Plans and estimates for a bridge across the river at the site of the old Dennis & Bradley bridge, are being prepared by Ockar Huber, City Engineer. If it is found that the bridge can be built for $4,000 it will be put up at once.

Rochester, N. Y.—State Engineer Adam has been directed to prepare plans for the Exchange street bridge in this city. A bill was introduced in the assembly, Jan. 19, authorizing the construction of a bridge over the Erie canal at Fitzhugh street.

Menasha, Wis. (Special.—W. W. Read, City Engineer, says the contract for a steel and iron bridge of nine 68-foot spans with stone piers and abutments, has been awarded to the Chicago Bridge and Iron Company of Chicago, Ill., for $15,670. The bridge is to be completed by May 25, 1897.

STREET CLEANING.

Hartford, Conn.—An experiment in uniforming the street cleaners is being tried.

Kansas City, Mo.—The Board of Public Works has ordered 200 galvanized iron trash receptacles, one to be placed on each street corner in the down-town districts.

Indianapolis, Ind.—The Board of Public Works awarded the contract, Jan. 22, to Andrew Hermany & Co. for collecting the city garbage for the next six years at $24,297 a year, or a total of $149,982.

New York, N. Y.—Col. Waring of the Street Cleaning Department, in a recent statement, Jan. 21, showed that the expense for the department for 1896 will be about $2,787,058.62, as against $2,704,577.26 actually expended in 1895, an increase of $82,481.36 for 1896 over 1895, or a little over 3 per cent.

PARKS.

Newark, N. J.—A tract of 130 acres has been added to the original plan of the Branch Brook Park.

Brooklyn, N. Y.—A scheme is suggested by Alderman Oltrogge of Flatbush to utilize the East Side lands for public park purposes.

Pittsburg, Pa.—Mayor Ford signed the ordinance, Jan. 19, for the purchase of the Robinson farm for a site for a public park on the South Side; cost, $62,500.

Orange, N. J.—The Essex county park commissioners have decided to buy a triangular plot of property, between Central avenue, Harrison and Center streets, to be used as a public park.

Milford, N. J.—Henry R. Worthington, New York, has purchased a large game preserve and park in Pahaquany township, Warren county, and will place there 142 deer and other game.

Philadelphia, Pa.—The Board of Supervisors, at a meeting, Jan. 18, considered a plan for the extension of Fairmount park at the upper end of the Wissahickon drive. The project was approved, but action was deferred.

ADDITIONAL TRADE NOTES.

The Blue Canyon Water Company, Sacramento, Cal., has filed articles of incorporation, its purpose being to furnish water from the Blue Canyon spring to households at two cents a gallon. The directors of the company are A. Meister, J. O. Rue, G. C. Simmons, F. T. Thomas and G. S. Turner.

The Gates Iron Works, Chicago, Ill., has added a new branch of industry to its business, in the Fischer-Gates single and four-valve self-oiling automatic high speed engine, built according to the design and under the patents of Mr. Fred Fischer. Plans have been completed for extensive additions to the plant of the company. The product will be handled by Fischer & Whiteside, 700-702 Fischer building.

Paris capitalists have obtained from the International Pavement company of this country the privilege to manufacture asphalt blocks in that city, and arrangements are now being made for the erection of a manufacturing plant. The Maryland Pavement company of Baltimore sold and shipped to a firm in Paris last spring 30,000 asphalt blocks to be laid as an experiment.

The Eclipse Paving Brick Works, near Hubbard, O., were offered for sale again Jan. 16, and for lack of bidders will have to be reappraised. The works were first offered for sale Dec. 14, but not be disposed of because there were no bidders. The plant was appraised the first time at $12,500.

The Utica Paving Company, Utica, N. Y., held its annual meeting Jan. 18, and elected directors as follows: Charles I. Williams, Henry W. Miller, John Harney, John L. Murray and Richard Richards. The directors eleected officers as follows: President, Charles I. Williams; Vice-president, John Carney; Secretary and Treasurer, John L. Murray.